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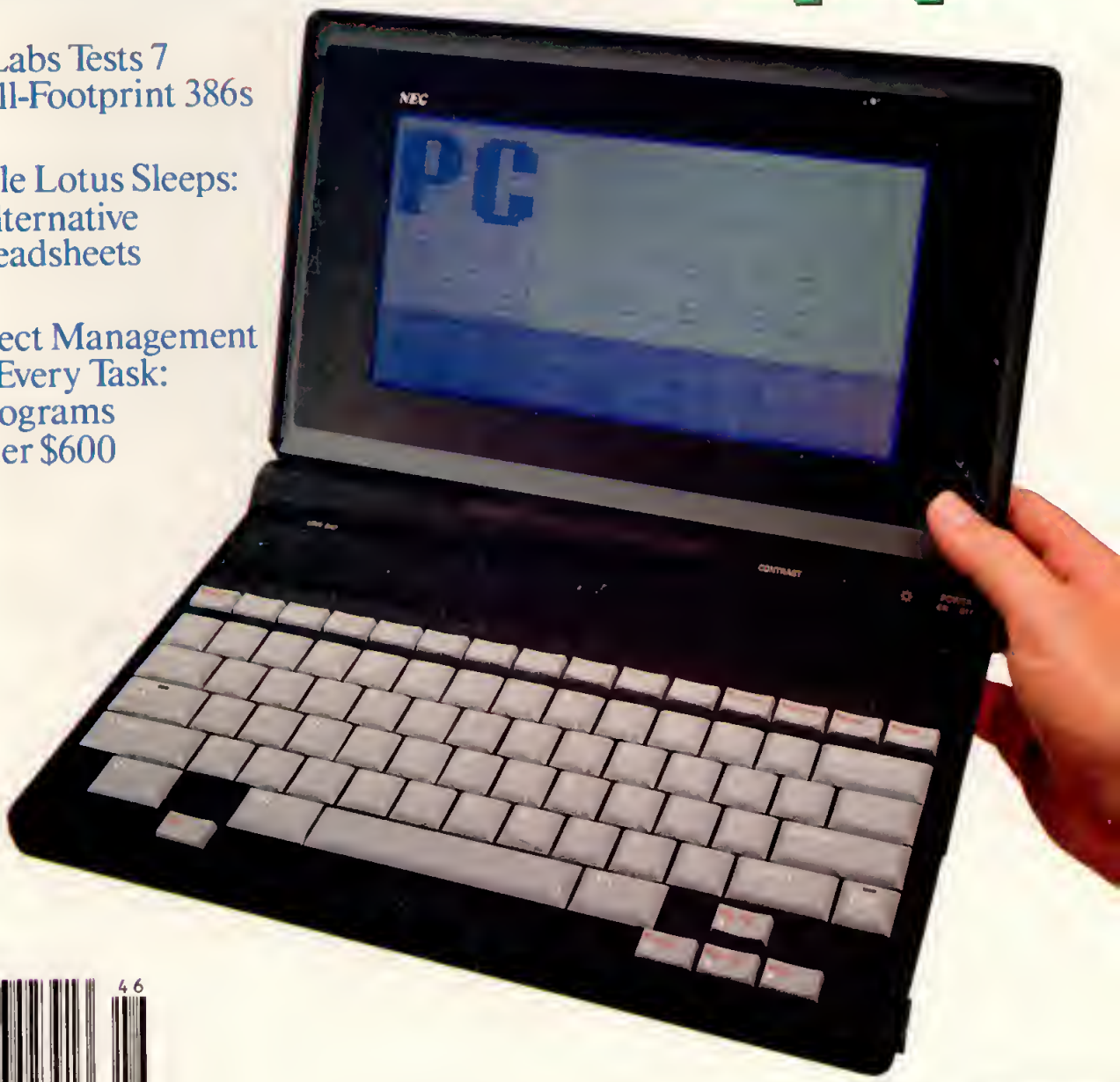
PC MAGAZINE

VOLUME 7 NUMBER 19
NOVEMBER 15, 1988

PC Magazine vs. the Readers, or Why You'll Still Never Want to Buy Another 286 Again

NEC's Incredible 4-Pound DOS Laptop

- PC Labs Tests 7 Small-Footprint 386s
- While Lotus Sleeps: 4 Alternative Spreadsheets
- Project Management For Every Task: 5 Programs Under $600



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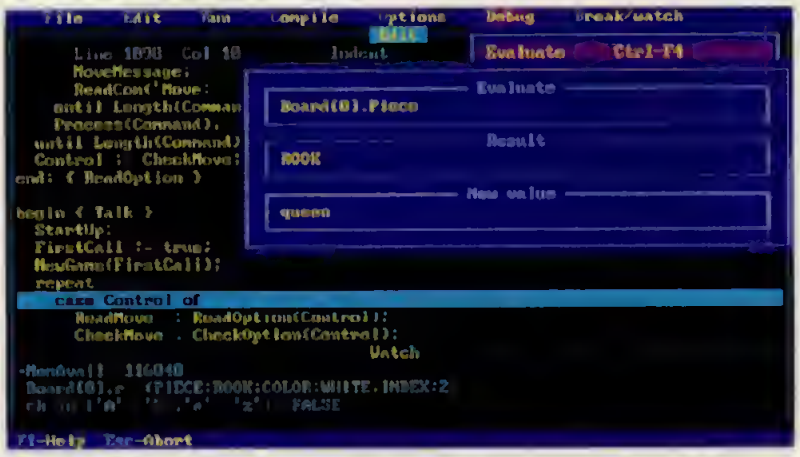
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TURBO PASCAL 5.0	TURBO PASCAL 5.0	Turbo Pascal 4.0
SIEVE BENCHMARK		
.EXE size (bytes)	1440	1504
Execution time (seconds)	6.15	7.25
FEATURE COMPARISON		
Integrated debugger	Yes	No
Overlays, including EMS support	Yes	No
8087 floating-point emulation	Yes	No
Turbo Debugger support	Yes	No
Procedural types, variables, parameters	Yes	No
Smart linking of code and data	Yes	No
Constant expressions	Yes	No
EMS support for editor	Yes	No

Benchmark (25 iterations) run on an IBM PS/2 Model 60

Feature highlights

- Includes the compiler, editor, and debugger, all rolled into one
- Integrated source-level debugger lets you step code, watch variables, and set breakpoints
- Overlays, including EMS support
- 8087 floating-point emulation
- Support for Turbo Assembler and Turbo Debugger
- Procedural types, variables, and parameters
- Smaller, tighter programs: Smart Linker strips both unused code and data
- Constant expressions
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Debugging: The inside story

Turbo Pascal's new integrated source-level debugger takes you inside your code to fix errors fast. Don't worry about errors, everyone makes them; but with the right debugger, this one, it's a fast fix.

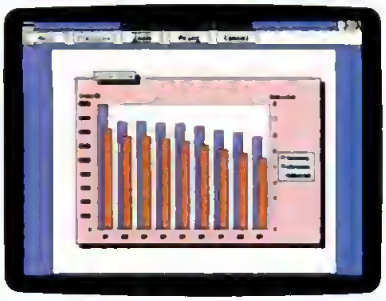
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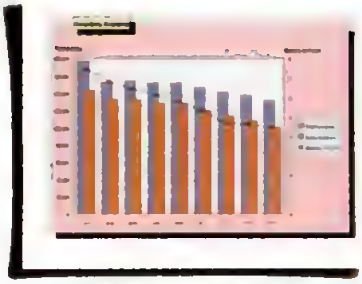
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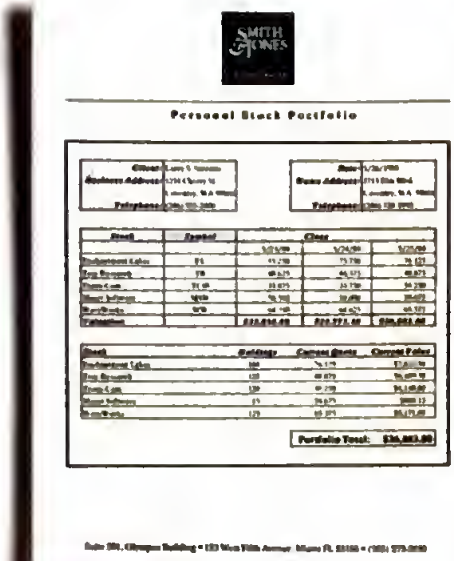


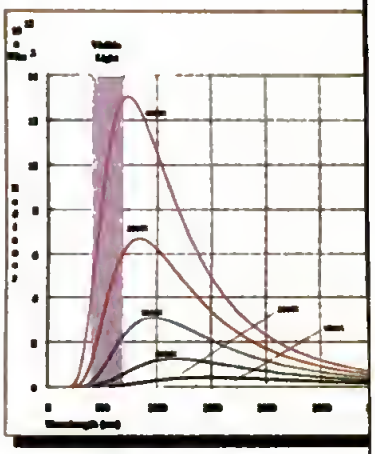
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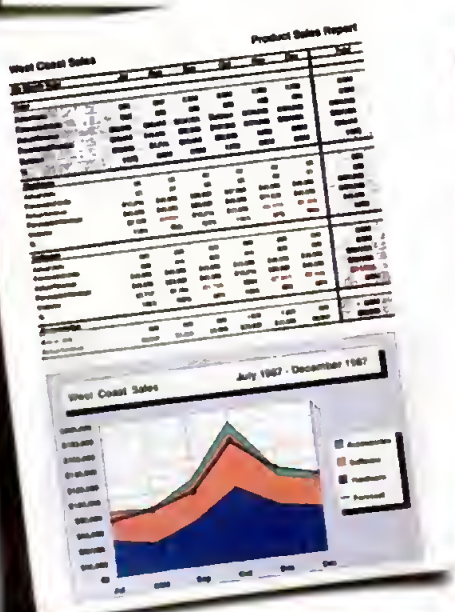


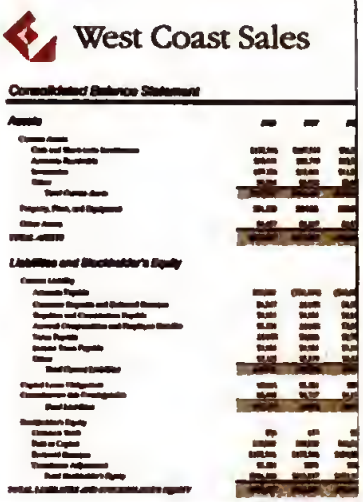
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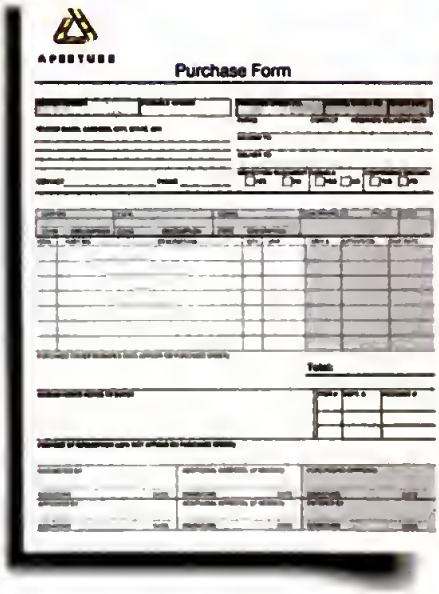
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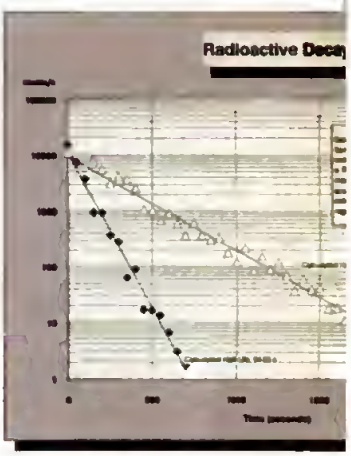


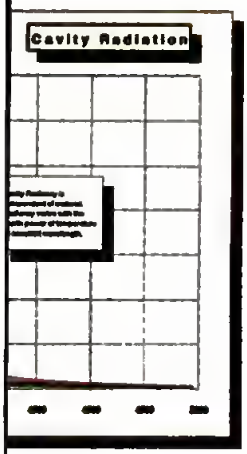




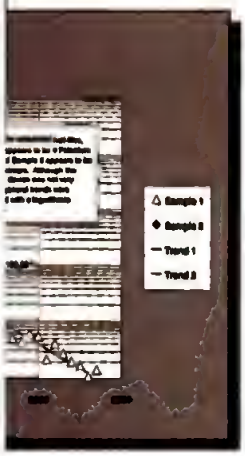












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WHAT'S INSIDE

The insatiable desire for smaller computers has driven technology with amazing results. When we planned this issue's lead feature on small-footprint 386 PCs, we had no idea that our cover would showcase the smallest DOS machine yet: NEC's Ultralite. But just 1 week before we went to press, we pounced on the first Ultralite to hit the U.S. Pages were cleared in the First Looks section while this remarkable notebook-sized computer was tested and probed by executive editor Gus Venditto and the PC Labs technicians. The result is an issue loaded with the latest and greatest space-saving PCs.



Finding out what's inside the IBM PS/2 Model 70 is assistant editor Stephanie K. Losee, who manages each computer story.

Whenever you want to know about the hottest computers at *PC Magazine*'s office, Stephanie Losee's the person to see. Our feature on small-footprint 386s is Stephanie's second article as assistant editor in charge of computer stories. She's the one who's occupied day in and day out with such details as checking FCC approval and the ability of vendors to ship their products—both tests used to determine legitimate computer-review candidates. In the course of Stephanie's investigations, our lineup of small-footprint machines dwindled to seven. And this final selection was culled from an initial shopping list of a dozen computers.

Drawing upon in-house writers for our coverage, Stephanie jeopardized her popularity with her overworked coeditors to pull off this, our first look at a cut of the sparse small-footprint 386 market.

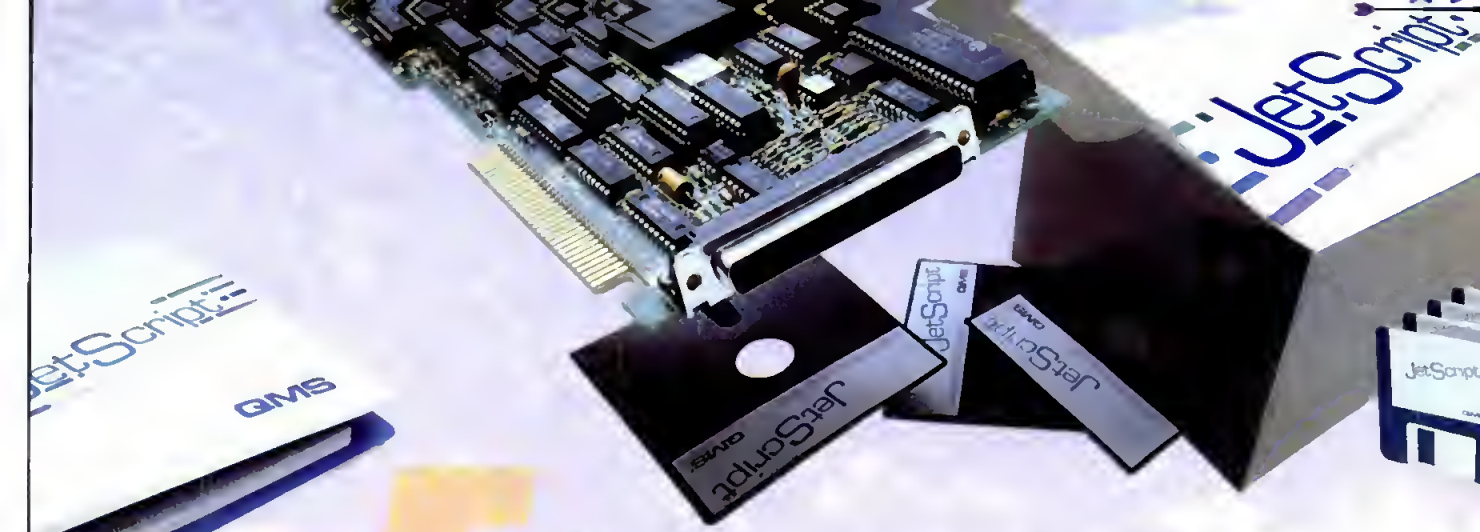
Little did we know what sort of Pandora's box was waiting to be opened when we decided to review an even tighter, more competitive market: corporate spreadsheets.

While Lotus delayed *1-2-3*, Release 3.0, from April to sometime this fall, Borland moved in with an aggressive ad campaign and a major acquisition of one of its chief spreadsheet competitors, *Surpass*. According to our reviewer, West Coast editor Jared Taylor, "*Surpass* buyers will not find themselves lost on a desert island. There will be an upgrade path for *Surpass* owners; the only odd thing about it is that it will be called *Quattro*." Once the reviews were completed, Jared hopped on the first plane to Tokyo to give a speech. Yes, Jared is fluent in Japanese, as well as in the *1-2-3*–macro language.

Those interested in gaining computer language fluency always turn first to *PC Magazine*'s Productivity pages. This issue's utility is TED (Tiny EDitor). A full-screen editor intended for line-oriented files up to 64K, TED lets you cut, copy, paste, and print. Even if you've been using the most powerful word processor, you'll appreciate TED's speed and simplicity. PC

Photograph: Alan Richardson

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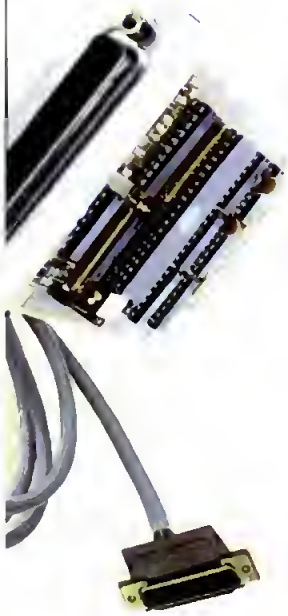
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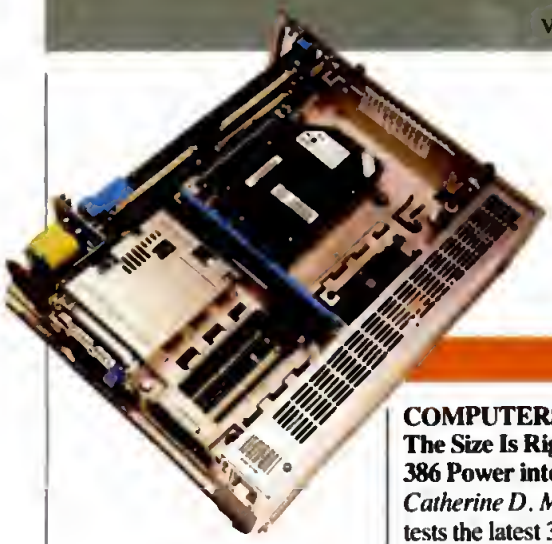
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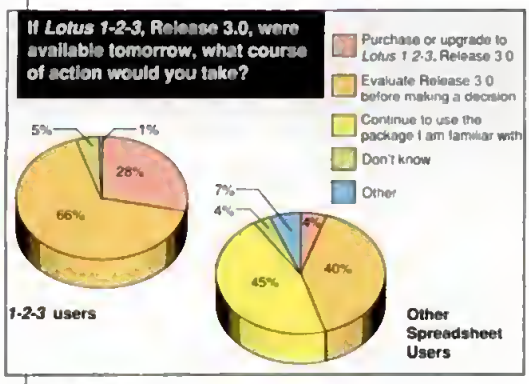


PC MAGAZINE

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Cover Photograph:
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- Borland rounds out its line with *Turbo Assembler*, *Turbo Debugger*, and *Turbo C* 2.0.
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The Tiniest Editor You'll Ever Need
FREE PROGRAM
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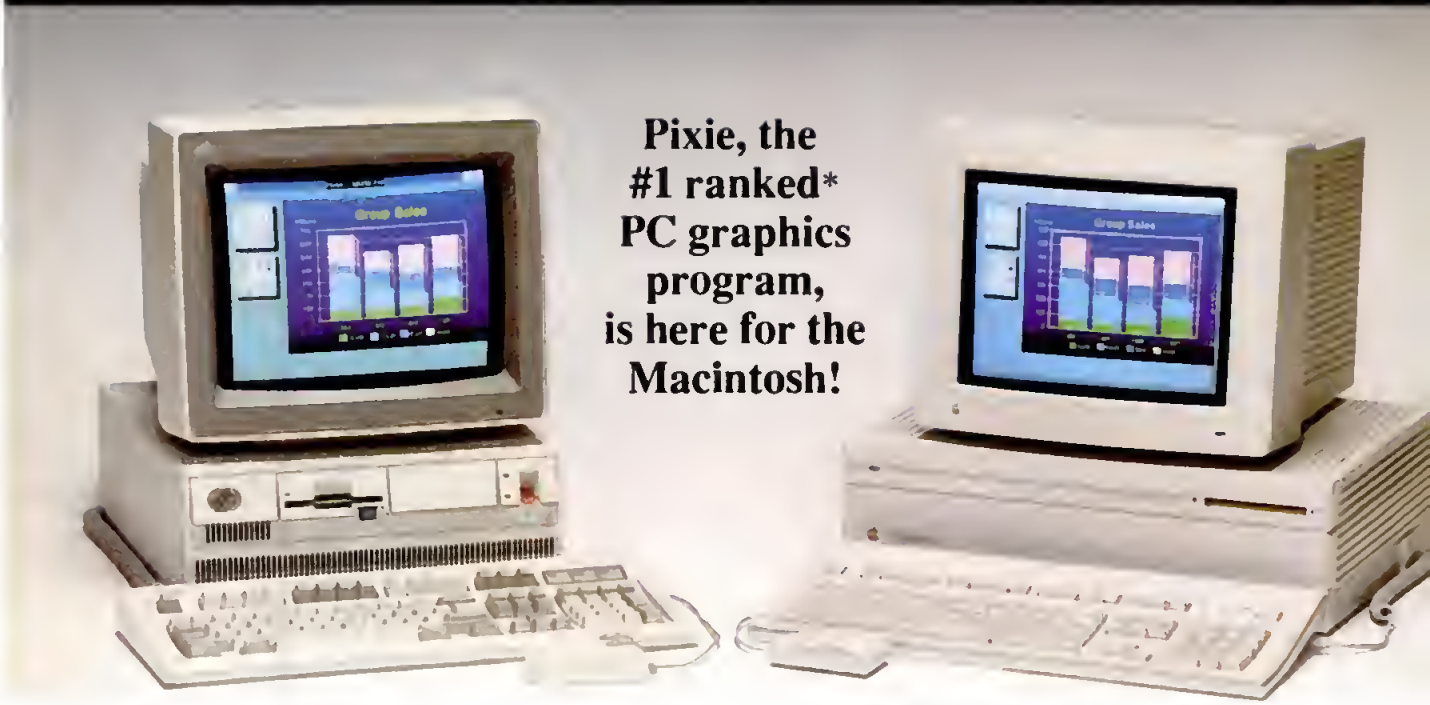
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BPA

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CIRCLE 325 ON READER SERVICE CARD

Any cell can contain a com
that you can access



Fig. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (Grey +).

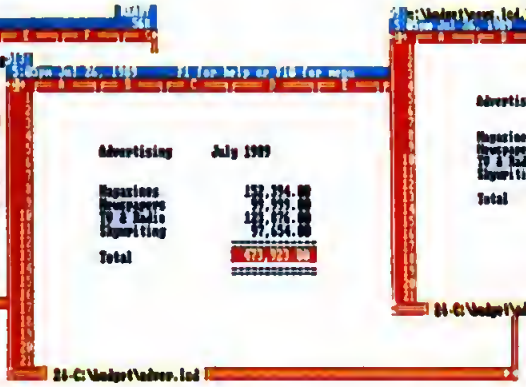


Fig. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up.

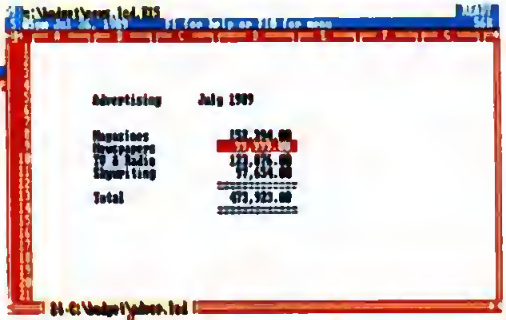


Fig. 3 We want more detail, so let's go to Newspapers. Just press the Grey+ key.



Fig.4 Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

What Makes Lucid 3-D So Special

In the screen examples you can see Lucid is really three dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that.

All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that way. Users say *"It is so intuitive that I really don't need a manual."* That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, *"If there ever was an interface idea so good it ought to be stolen and widely used, this is it."*

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 600 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

> "I've been calling it an 'Everyman's Spreadsheet', and I think that's how the market will position it. It's much more than an inexpensive alternative to 1-2-3."
>
> **Jim Seymour, Columnist, PC Magazine, PC Week**

Speed

Lucid 3-D™ is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D™ also lets you teach it in any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you

plete other spreadsheet with a single key.

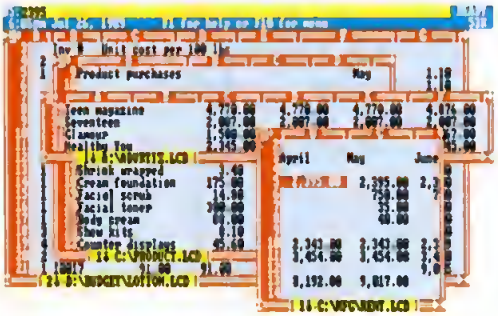


Fig. 5 Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many 3-D levels as you like. No one else can do that.

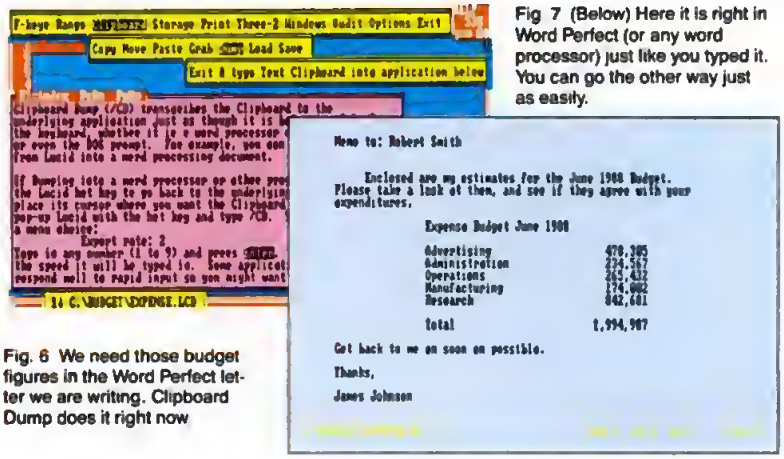


Fig. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now

Fig. 7 (Below) Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D™ was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D™ menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D™ has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember, Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid 3-D™ offers five audit displays and printouts.

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D™ without having to upset your present systems.

We are excited about Lucid 3-D™. But don't take our word for it, take us up on our 60 day offer.

Call us on our order line number and we will ship your order the very next day. This $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

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What you've been doing.



On your 286,
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If the screens on the right look more intriguing to you than those on the left, you're ready for Microsoft® Windows.

Windows opens up the world of visual thinking to all 286 and 386 owners by offering the power of graphics.

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Stop playing with ancient instruments. Now cutting and pasting is a simple point and click with the Microsoft Mouse.

And once you've learned Microsoft Windows, you'll have the basis for scores of other programs because all the countless new Windows applications are based on the same easy, logical format.

Since Microsoft Windows virtually looks and works like MS® OS/2 Presentation Manager, you won't have to worry about it becoming obsolete in a couple years. We made both systems compatible. So, in the future, you'll be able to share data between them. And your knowledge of Windows will give you a jump on learning MS OS/2 Presentation Manager.

You'd expect a program this powerful to require a more powerful machine. But we consistently create software that makes

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The following products have been used courtesy of their respective developers: Lotus and 1-2-3 by Lotus Development Corporation; WordPerfect by WordPerfect Corporation, PageMaker by Aldus

What you could have been doing.



With Windows/286,
you could have been seeing things much more clearly.



With Windows/386,
you could have been seeing a lot more things much more clearly.

the best use of your present hardware.

For example, Microsoft Windows/286 will work with as little as 640K and instantly make your machine more sensitive, intuitive and highly visual. It gives you the ability to run every Windows application available.



And with access to all those powerful programs, you'll be able to extend the life and usefulness of your 286 well beyond the introduction of MS OS/2 Presentation Manager. With version 2.1 you also get the benefit of increased speed. So you'll blaze through Windows applications up to 87% faster.

Microsoft Windows/386 will give you everything that Windows/286 gives you. Plus multitasking with most DOS applications. Now you can finally utilize the speed and power of any 386 machine.

Imagine creating a complicated spreadsheet. Then while a macro is being run, open up a word processor. Type a document, open and work with a graphics program. Cut and paste between programs and even call up electronic mail. And still be able to check on the status of your spreadsheet at any time.



Considering all you can do with Microsoft Windows, you have only one question to ask yourself.

What have you been doing without it?

Microsoft®

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Introducing Wells American's CompuStar® Multi-Bus Business Computers. The world's first and only multi-processor, convertible bus™ microcomputers.

Ask any computer expert about what type of system you should buy nowadays and you'll likely get a "pass the bus" response. Something like — "Well, uh, the PC/AT* bus is your best buy but, then again, the new PS/2* bus may become the next industry standard." Great advice, right? If trying to decide on a processor weren't tough enough, now you're expected to pick a bus, too.

RELAX, NOW THERE'S COMPUSTAR.

The all new CompuStar® from Wells American not only lets you interchange microprocessors, you can also mix and match buses — a PC/AT bus, a PS/2 bus or. . .both. As your computing needs change, simply snap in a new processor or add an extra bus. You'll never again have to worry about buying the *wrong* computer system!

FOUR COMPLETE SYSTEMS IN ONE.

The CompuStar can be configured with any of four microprocessors — an 8086, an 80286, an 80386SX, or an 80386. The processor and up to *16* megabytes of user memory have all been combined, using the latest VLSI technology, on a single, plug-in CPU module. Plus, any time during the first year of ownership, CompuStar users can "trade-in" the CPU module they initially selected toward the purchase of any of the other more powerful modules. *Nobody* but Wells American gives you this kind of value.

CONVERTIBLE BUS? YOU'RE KIDDING!

No, we're not. In fact, it may well be the most practical microcomputer innovation ever. Say you've selected an AT compatible CompuStar and later want to add PS/2 compatibility. No problem! Snap in a PS/2 Bus and Adapter Module and you can use *both* buses in the same system. Likewise, if you've selected a PS/2 compatible CompuStar and decide you want to add an AT bus, just snap in an AT Bus Module. Depending on configuration, the CompuStar can have up to *13* bus expansion slots — all AT slots, all PS/2 slots or a "split-bus" of AT *and* PS/2 slots. Best of all, you can reconfigure your CompuStar whenever you want.

$1995



The CompuStar is also easily expanded. That's because there are *seven* CompuStar disk/tape compartments — six accessible from the front and an additional full-height bay inside. All this in a sleek, compact tower design that actually leaves more room on your desktop than any of the so-called "desktop" models.

A NEW IDEA FROM AN OLD COMPANY.

The CompuStar® Multi-Processor, Convertible Bus™ Microcomputer. It's no surprise that our engineers invented it. After all, we've been making microcomputers longer than anyone else. . .even longer than IBM! And if that kind of experience doesn't impress you, CompuStar's service programs surely will. You can select an optional overnight module swap-out plan or on-site service from General Electric Corporation — one of the most respected names in consumer electronics. And, of course, every CompuStar carries a full one-year factory warranty.

FINALLY, AFFORDABLE TECHNOLOGY.

Think all this technology sounds expensive? It's not. CompuStar 20MHz 80286 systems start as low as $1995†. There are also inexpensive 8086 and powerhouse 25MHz 80386 systems available. Plus, there is a wide variety of CompuStar display, tape and disk options including a one gigabyte erasable optical disk. You can choose a factory preconfigured CompuStar or custom design one yourself. Just unlock the front panel and literally "snap-in" a bus, CPU or disk module in a matter of seconds. It's system flexibility never before available. . .at *any* price.

While one of our competitors (we won't mention any names) threatens you with "missing the bus," most simply *pass* the bus. Our new CompuStar however, *eliminates* the bus problem altogether. Not to mention the processor problem. Even the expansion problem. Prove it to yourself. Call today about our CompuStar 31-day trial offer. Oh, and by the way, the next time anyone asks, tell 'em you know where the bus stops.

Wells American.

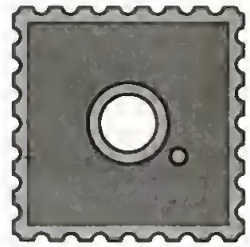
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CIRCLE 515 ON READER SERVICE CARD

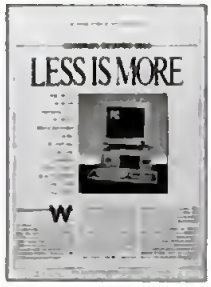
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LETTERS TO PC MAGAZINE



THE REAL COMPETITION

How can anyone rave about Compaq (First Looks, page 33, and "Compaq's Deskpro 386S: Less Is More," *PC Magazine*, August 1988)? The 386S machine has a proprietary memory bus, a separate, optional (at-extra-cost) VGA that fits into a proprietary system board connector, and three DIP switches on the system board. *DIP switches!*



The IBM PS/2 Model 70-A21 has a 64K memory cache, in contrast to the 32K cache of Compaq's Deskpro 386/20 and 386/25, with faster DRAMs and a 128K ROM shadow. There are those of us who don't hate IBM, and we could do without reading your reviewers' prejudices.

Ray Smith
Costa Mesa, California

The IBM PS/2 Model 70-A21 had not yet been announced when the Compaq Deskpro 386S was introduced; when it was, PC Magazine's *reviewers duly noted its outstanding design and performance (see First Looks, page 35,* PC Magazine, *September 13, 1988).*

All 386 machines use a proprietary memory bus, which is necessary to achieve the performance required by the faster processors. In addition, the IBM PS/2s you admire have proprietary VGA circuitry built into the system, just as the Compaq does.—Ed.

The 386SX does not satisfy the real market needs ("The Little Chip That Could" and "Secrets of a Chip's Success," sidebars to "Compaq's Deskpro 386S: Less Is More"). For those who are price sensitive, a 16-MHz 286 runs just as fast, still runs 99 percent of all DOS and OS/2 software, and is less expensive than the 386SX. For those who are "power users," the 386SX offers half the MIPS performance of a 386 at nearly the same system cost.

Kevin Dwyer-Krewell
North Merrick, New York

Today's DOS and OS/2 software will run just as well on a fast 286 PC, but that is not enough for the cascade of 386-only software beginning to flow into the market. The 80386SX and the PCs that have been built around it will do that job just fine at about one-half to two-thirds the cost of a standard 80386.—Ed.

There is no question that Intel's 386SX chip is better than the 286 chip ("The Little Chip That Could"). Unfortunately, the 386SX is not competing against the 286.

The full-speed-ahead 386 chip costs only $79 more than the 386SX and does everything it does and more. Why go down the blind alley of less performance when I can move up to a complete 386?

Steven Vaughan-Nichols
Lanham, Maryland

THE WORD ON WORDPERFECT

Three years ago, I converted from *WordStar Professional* to *WordPerfect* for its ease of use, flexibility, compatibility, and power. Then *WordStar* 4.0 came out—not bad. But now *WordStar Professional* 5.0 is here and, in my opinion, outperforms *WordPerfect* 5.0.

You need to get fresh copies of *WordStar Professional* 5.0 and *WordPerfect* 5.0 and do a benchmark-test comparison between the two. I'm willing to bet that MicroPro International is back on top.

Carol Lee Womble
Chantilly, Virginia

I had to laugh when I read "WordPerfect 5.0: Was It Worth the Wait?" (First Looks, page 48, *PC Magazine*, August 1988). I received my upgrade over 2 months ago, and I'm still waiting.

WordPerfect 5.0 doesn't work properly with my Hewlett-Packard LaserJet Series II. I can mark only fewer than half the fonts I have before *WordPerfect* thinks that I have run out of "Available Quantity."

One would think that a program being touted as "desktop publishing" would be able to divine what fonts are to be used in a document before printing it!

Paul Songer
Seattle, Washington

A WRITE-IN VOTE?

David DeJean's response to his critics (Letters, *PC Magazine*, August 1988) for not having selected *Fastback Plus* as an Editor's Choice ("Software Safety Nets," *PC Magazine*, May 31, 1988) was an outstanding example of authors' "gobbledygook." Not only did he fail to address the legitimate criticisms, his obfuscation was an insult to the intelligence of his readership. Such a reply should qualify him to run for political office.



James A. Cunningham
West Granby, Connecticut

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■ LETTERS

NETWORKING KNOW-HOW

I have been investigating networking the PCs in our offices, and Frank J. Derfler, Jr.'s comprehensive coverage has made



the job much easier ("Software: Connectivity's New Frontier," *PC Magazine*, June 14, 1988). Once again, your magazine has proved itself to be a good tool for decision making in the computer industry.

William Schweighofer
Honesdale, Pennsylvania

VIEWER DISCRETION ADVISED

How could you possibly write that the Apple LaserWriter and LaserWriter Plus "were not ready for PC prime time" ("No-Wait LaserWriters," *PC Magazine*, August 1988)? These two printers virtually created the phenomenon of desktop publishing!

If the printers that defined desktop publishing weren't readily available to the PC world because: (a) PCs lacked the tools to exploit them, and (b) serial interfacing requires a little sophistication, then which was not ready for prime time—the LaserWriter or the PC?

J.S. Kelly
Jacksonville, Florida

EPSON: TRY, TRY AGAIN

If Scot Edwards thinks that Epson America is beyond reproach (Letters, *PC Magazine*, September 13, 1988), he must not have been with the company when the QX-10 was introduced.

The QX-10's accompanying operating system, Valdocs, was probably one of the buggiest pieces of software ever released. Several updates were released, but they never fulfilled the promises that were made when I bought the computer. Another update, which also proved to be insufficient, was later offered at a cost of several hundred dollars. Eventually, Epson abandoned both the project and the end users.

Kent Loose
Miamisburg, Ohio

DRUG WARS

Congratulations to *PC Magazine* for the fine advertisement by the Partnership for a Drug-Free America ("Cocaine lies . . . ." *PC Magazine*, page 460, August 1988). Not many computer magazines would be willing to make that type of statement.

Jack Gurly
Wichita, Kansas

I am writing to protest the advertisement placed by the Partnership for a Drug-Free America ("Cocaine lies . . . ."). It

■ "Cocaine Lies . . . ." offended me in many ways, not the least being its appearance in "The Independent Guide to IBM-Standard Personal Computing."

offended me in many ways, not the least being its appearance in a magazine that calls itself "The Independent Guide to IBM-Standard Personal Computing."

Larry Dorau
Star Prairie, Wisconsin

The Partnership for a Drug-Free America's advertisement was a complete waste of space ("Cocaine lies . . . ."). I fail to see the connection between cocaine and computers. Let's leave the War on Drugs out of this special-interest magazine and concentrate instead on the War on Bugs.

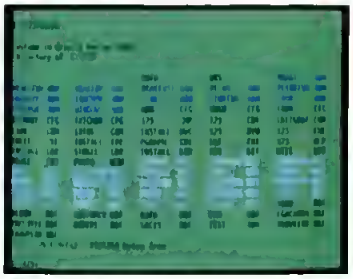
James G. Jackson
Lakewood, Colorado

HLP!

You frequently carry articles about presentation graphics software and hardware, but



Get VGA graphics resolution on any EGA with autosync monitor for AutoCAD, Windows and Ventura Publisher.



Give DOS a new look. You can even color code directory listings by file extension.



See more on the screen when you write code or review program listings in editors like Brief. 120 × 43 shown.

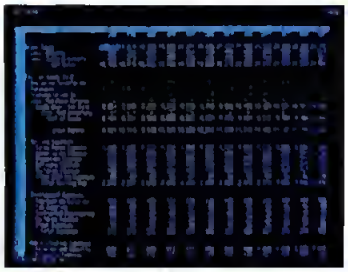


Change fonts, colors and screen sizes in popular word processors like WordStar & Word Perfect. 80 × 60 shown.

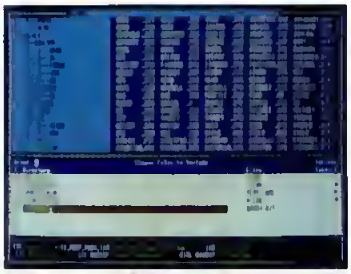




Enhance colors and add fields to any dBASE data entry form. 80 × 43 shown.



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These unretouched photos demonstrate how UltraVision improves character resolution on any EGA with autosync monitor. Normal EGA characters are defined in an 8 × 14 matrix versus 9 × 19 for UltraVision.

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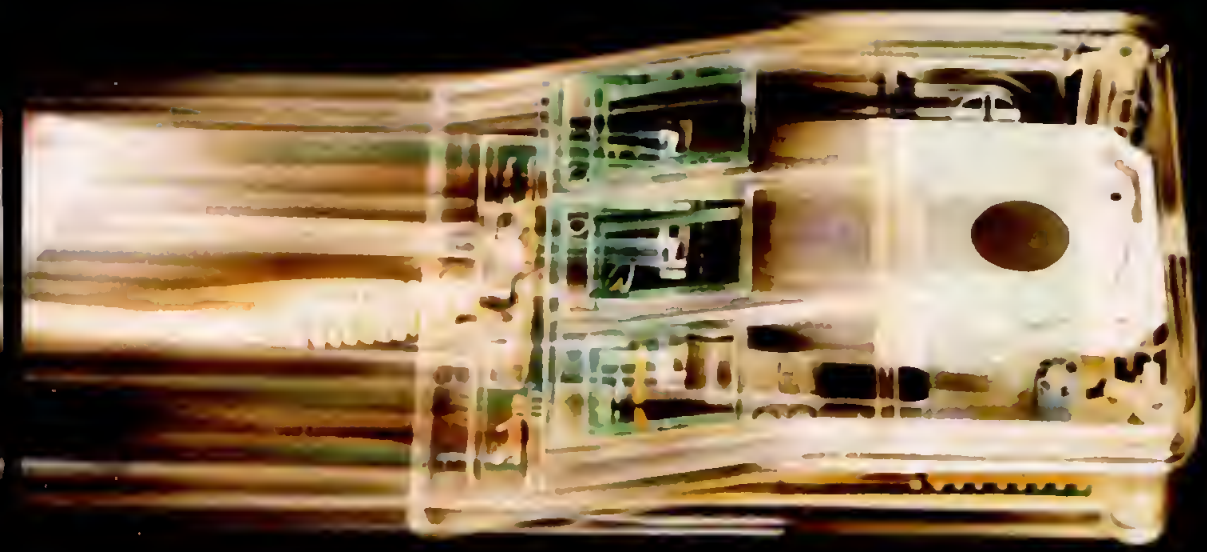
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■ LETTERS

the topic of file formats remains increasingly confusing (and unreported). How about devoting an article to this topic and, in particular, to the competition among so-called "emerging standards"?

Mark Borthwick
Falls Church, Virginia

PC Magazine *will include a discussion of file formats in the desktop publishing feature scheduled for December 27, 1988.*—Ed.

RETHINKING CADD

Your CADD feature ("High-End CADD: Expanding to New Dimensions," *PC Magazine*, August 1988) was superficial, inaccurate, and a disservice to potential CADD buyers. The speed comparisons failed to distinguish between a display list redraw and a true database regeneration, and they did not discuss the influence of file size on response time.



The article also avoided discussing several well-known problems with *AutoCAD*, Release 9, the Editor's Choice. *AutoCAD* has no intraline text editing, the transparent zoom doesn't work if you need a regeneration, and the editing features are second-rate.

Steven M. Lord
Bedford, Massachusetts

We are constantly refining our benchmark tests to represent the real-life needs of users. In the future, we will distinguish between simple-screen redraws and full-screen regenerations.

A product's designation as Editor's Choice does not mean that the package is perfect; it simply indicates that when compared in performance and price with its competitors, it earns the highest marks. AutoCAD *fits these criteria.*—Ed.

BACK TO BASICS

Richard Hale Shaw's article ("Writing Optimal C: Part 1," PC Lab Notes, *PC Magazine*, August 1988) failed to stress what I consider to be a fundamental rule in programming: "Choose your algorithms carefully. No amount of clever code or bit fiddling will speed up a poor algorithm."

For *every* programmer I highly recommend *The Elements of Programming Style*, by Kernighan and Plauger. It contains a wealth of basic programming rules that even experts sometimes forget.

Robert Feinberg
Los Angeles, California

CORRECTIONS/AMPLIFICATIONS

Our review of *The Resident Expert System* ("Pop-up Help: Instant Answers at Your Fingertips," *PC Magazine*, August 1988) did not cover the most recent version of the Shell Program. The Shell Program, Version 1.1.4, now supports more lines of text and has "movable" windows. In addition, it incorporates a Control Panel feature that allows users to adjust the hotkey and change screen colors.

The correct price of *For Record Collectors* is $59.95, not $129.95 (PC Advisor, *PC Magazine*, August 1988).

Xiox does provide true V&H pricing in its call accounting systems ("Call Accounting: Tracking PBX Costs," page 255, *PC Magazine*, August 1988), and password protection is available.

While the IBM Music Feature card is hardware-compatible with MIDI synthesizers (After Hours, *PC Magazine*, September 13, 1988), it is not compatible with the Roland MPU-401 instruction set.

The MIDI interface included in the MIDI Starter System, from Music Quest Inc., is compatible with the Roland standard. The Music Quest board also has a metronome connector as standard equipment.

The correct name of the computer graphic artist for the cover of the September 27, 1988, issue is Alan Waxenberg; PCSI, New York.

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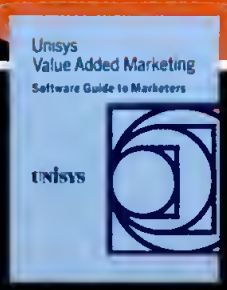
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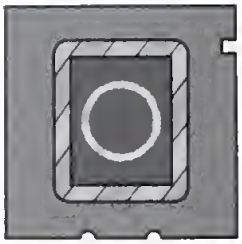
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■ JOE DESPOSITO



PC ADVISOR

Help with finding a program that lets you hide a subdirectory from DIR, and information on choosing software to use with bar code readers.

NOWHERE TO HIDE

Help! I'm looking for a method to hide subdirectories from DIR. I've tried using unprintable characters in subdirectory names. I've also looked for a utility that would set the hidden bit for a subdirectory name. Have you any ideas?

Don Trivette
Wrightsville Beach, North Carolina

All DOS files and subdirectories contain attribute bits that can be turned on and off. One of these attributes, called "hidden," causes a file or subdirectory not to be listed when a DIR command is issued. Thus a casual user would not even be aware that a hidden file or subdirectory existed. A good example of hidden files are the IBMBIO .COM and IBMDOS.COM files that come with PC DOS.

DOS has a command called ATTRIB that lets you turn on and off the read-only and archive attributes of files, but not the hidden attribute. To turn this on and off requires a program such as ATTR.COM, which is one of the PC Magazine *utility programs.*

To change a visible subdirectory such as PERSONAL to an invisible one, you simply type ATTR +H PERSONAL. This turns on the hidden attribute for the PERSONAL subdirectory. Now when you type DIR, the PERSONAL subdirectory does not appear in the listing. However, you can still change to the subdirectory and use any file that it contains.

ATTR.COM and all other PC Magazine *utilities can be found on PC MagNet. A detailed explanation of PC MagNet and how to join it is in the May 31, 1988, issue of* PC Magazine (page 46).

There are many commercial programs that will let you change the hidden attribute for subdirectories, among many other things. One that we recommend is Q-DOS *from Gazelle Systems (42 N. University Ave., #10, Provo, UT 84601; (800) 233-0383 or (801) 377-1288), which sells for $79.95; another one is* The Norton Utilities—Advanced Edition *(Peter Norton Computing, 2210 Wilshire Blvd., #186, Santa Monica, CA 90403; (213) 453-2361), which sells for $150.*

One cautionary note about hiding subdirectories: don't expect this simple technique to give you a great deal of data security. First of all, anyone using a program such as Norton's Advanced Edition *can just as easily turn off the hidden attribute as turn it on. Moreover, an alert user can usually find out whether there are hidden files or directories on a disk just by using CHKDSK and a little common sense. (There's nothing like a few megabytes of unaccounted-for disk space to start you wondering.)*

■ All DOS files and subdirectories contain attribute bits that can be turned on and off. "Hidden" is one of these attributes.

If data security is really what you are aiming for, you might consider purchasing a security program that will protect your files from unauthorized access. A new product on the market that provides security for your files is SoftSafe *from Software Directions (1572 Sussex Tpk., Randolph, NJ 07869; (201) 584-8466).* SoftSafe *automatically encrypts data stored in secured directories and has the ability to lock the keyboard of an unattended computer.* SoftSafe *uses passwords to identify users, allowing only someone with a valid password access to the computer. Users with passwords are then assigned individual IDs so that each can protect his or her files from other users. Suggested retail price of* SoftSafe *is $99.*

NOTHING TO SCAN

The article on bar code readers, "Reading Between the Lines" (*PC Magazine*, June 28, 1988), was outstanding. But what about the other half of the problem?

Where can one find PC-based software to print bar code labels? Is there software that will print bar codes as well as other label information?

Jim Cheston
Vineland, New Jersey

There is certainly PC software available to print bar code labels. The first place to look for software is from the manufacturer of the bar code reader. One of the major

■ PC ADVISOR

hitches in building a reliable bar code system is the quality of the bar code label. If you buy the bar code software from the bar code reader manufacturer, you will at least have a basis for complaint if the two don't work together as reliably as you would like. You are not limited, however, to a hardware vendor's software.

The test codes for the article (used with all readers) were produced with Computer Kitchen *from ITS (635 N. Berry St., Suite C, Brea, CA 92621; (714) 990-1880). This bar code package, which works with Epson, IBM, and C. Itoh dot matrix printers, sells for $99. ITS also sells a RAM-resident program called* Print Bar II *that lets you insert text above or below the bar code. The program works with a variety of dot matrix printers, as well as with HP LaserJet and LaserJet-compatible page printers.* Print Bar II *sells for $295.* Soft-Font *is another ITS program that lets you download bar code "fonts" to an HP LaserJet or compatible printer. This has a suggested retail price of $225.*

■ One of the major hitches in building a reliable bar code system is the quality of the label.

Keep in mind that the quality of the bar code depends very much on the printer that you use. Russ Adams, contributing editor of Automatic I.D. News *(Edgell Communications, Cleveland, Ohio), notes that dot matrix printers, for example, produce bar codes with jagged edges. Also, the density of the bar code that a dot matrix printer can produce is limited. And unless the ribbon is rated as "OCR quality," the bar code is often unreadable under an infrared scanner. In addition, both old and new ribbons can cause problems. Old ribbons produce weak or broken bars that don't have enough contrast to be reliably read, while new ribbons rich with ink cause the bars to spread and produce bar widths that are out of specification.*

And laser printers are not a panacea, either. Adams points out that laser printers cannot use continuous-form label stock, so printed labels cannot be put into automatic label equipment. Also, toner can be pulled or scratched from the paper it has been fused to. Thus labels printed by laser may eventually show signs of wear from repeated scanning with contact readers.

ASK THE ADVISOR

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PC MAGAZINE

FIRST LOOKS

NEC's 4.4-Pound UltraLite Sets a New Standard for Portable Machines

PC HANDS ON

BY BILL MACHRONE

The NEC UltraLite has an undefinable quality that affects everyone the same way: they want to pick it up. More than any other laptop, it demands to be hefted, handled, coddled. Its smooth black Lexan case invites touch. But there's danger in that touch.

Because once you touch it, you won't let go. You open it up, turn it on—surprise, the screen is backlit—and you're hooked. As you explore the features, your addiction only grows more hopeless.

The processor is a NEC V30, an 8086 equivalent, running at 9.54 MHz. It has the requisite 640K of DOS memory, plus 1MB, or optionally 2MB, of RAMdisk. The RAMdisk emulates a hard disk, right down to being formattable and inspectable with various disk utilities. The overall effect is akin to using an AT with a *very* fast hard disk. The RAMdisk is backed up by a separate battery, which lasts for several weeks even if the main battery is completely discharged.



As with all laptops, the keyboard is of paramount importance. This one is different, but terrific. The key travel is only 2 millimeters, more than a millimeter shorter than standard keyboards. But the keys are full-size, with a nice over-center tactile feedback. The keys land

(continues on page 35)

IBM Resurrects AT Bus with Its 10-MHz PS/2 Model 30 286

PC HANDS ON

BY MITT JONES

Nearly a year after IBM halted production of its AT in favor of its platform of the future—the PS/2 systems and their Micro Channel architecture—it has reintroduced the AT bus in the form of the PS/2 Model 30 286.

The low-key atmosphere of the midtown Manhattan announcements and the machine itself make IBM's position clear: it's willing to make a profit off those who insist on buying a true-blue AT-bus machine, but if you want power-user prestige and performance—even by last year's standards—you'll have to look elsewhere in the PS/2 line. The Model 30 286 is merely a 10-MHz workstation in IBM's connectivity-minded plans.

The most attractive aspect of the new machine is its price. Based on a cost-cutting AT chip set developed by VLSI Technologies, the Model 30 286 lists at $2,595 with a 20MB hard disk and $1,995 without—not bad by IBM standards.

From the front, the Model 30 286 is indistinguishable from the Model 30, unless you bother to read the model number on the IBM label. The chassis builds on the design of the original Model 30 box, boasting the same space-saving dimensions (15.6 by 16 by 4 inches, HWD) and sleek PS/2 look.

A system lock toward the front of the right panel recalls the AT system lock, if only out of wishful thinking: for all its niceties, the Model 30 chassis imposes serious limitations on this AT-bus reincarnation.

For starters, you'll find only two disk drive bays. A 1.44MB

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Turbo Assembler, Debugger: Innovative Software, Unworthy Documentation

PC HANDS ON

BY ROBERT L. HUMMEL

Borland International has expanded its line of programming language products with the introduction of Turbo Assembler 1.0 and Turbo Debugger 1.0. Turbo Assembler (TASM), a full-featured DOS macro assembler, was designed to compete directly with Microsoft's Macro Assembler 5.1. Turbo Debugger is a powerful, windowing, source-level debugger that fills a long-standing gap in the Borland line.

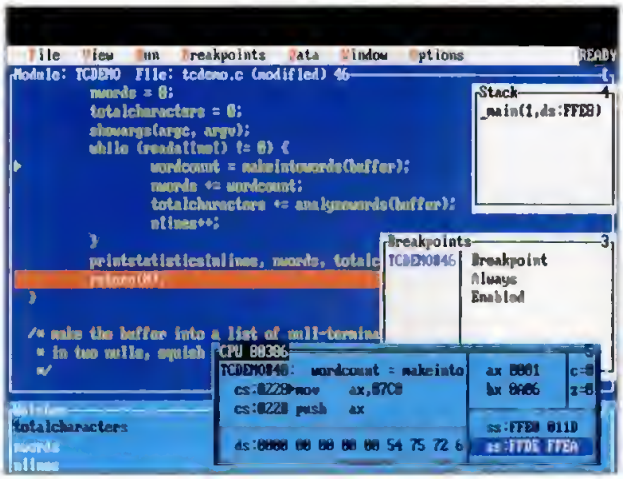
Turbo Assembler is what I would have expected the next version of Microsoft's MS-MASM to be—significantly faster, with full, working support for the special features of the 80386. Turbo Debugger is such a wonderful program that it takes a thesaurus to describe: it's flexible, powerful, customizable, versatile, and fun to use.

Compatibility with MS-MASM has been taken to the extreme by Borland's TASM designers. Using command-line switches, you can instruct it to emulate MS-MASM 4.0, 5.0, and 5.1. This comes in handy when assembling source code from different sources. TASM also excells when it comes to performance, producing an .OBJ file from a source file approximately two to three times faster than MS-MASM.

We hoped that TASM would run in an environment that contained a built-in editor and menus and would put you right at the line that has to be fixed. Unfortunately, TASM is a standalone, command-line program that contains none of these innovations.

Turbo Assembler comes with the usual DOS utilities: linker, make, librarian, cross-referencer, object file cross-reference, and GREP utility. The linker, TLINK, is about three times faster than Microsoft's LINK, but it isn't a full implementation. It doesn't support overlays and can't link code compiled with Microsoft C or FORTRAN.

The assembly-language extensions unique to TASM are really not too exciting. For example, the command-line syntax now allows wildcards in file specifications. Other enhancements, including nested structures, extended listing controls, alternate directives, and ideal mode, are also relatively minor.



Turbo Debugger's overlapping windows allow you to display the source code, CPU registers, breakpoints, and watch variables simultaneously.

Borland has been roundly (and rightly) criticized for its lack of debugger support for its programming languages. While Microsoft has evolved DEBUG to SYMDEBUG to CodeView, Borland had to start its work from scratch. The difference is clearly visible.

Turbo Debugger uses multiple, overlapping windows. One window may display the program source code, another the CPU registers, and a third the breakpoints you have set. A unique logging feature can be used to document a debugging session for future reference.

The gamut of breakpoints, watchpoints, and tracepoints are supported. All breakpoints are conditional and can be programmed to print expressions, run code, make entries in the log, or call user-defined functions. The facility for data examination is also advanced: examining an array brings up a view of the entire array. And Turbo Debugger's macro facility makes repetitive command sequences easy to use.

Turbo Debugger can take advantage of the virtual machine mode in an 80386-based PC. "Virtual debugging" lets the program you're debugging use the full memory of the PC. This mode gives you nearly the full power of a hardware debugger. For non-386 systems, "remote debugging" allows the Turbo Debugger to be run on one PC while the program being debugged is run on another. The two systems communicate using the serial port. Built-in EMS support provides another method of getting the debugger out of main memory.

Using Turbo Debugger is like playing a video game. You can drive yourself crazy by opening all the possible windows and playing "guess what command works here." Fortunately, you can learn essential commands quickly.

Users should note that only Turbo Pascal 5.0, Turbo C 2.0, and Turbo Assembler 1.0 support Turbo Debugger. Any program compiled using a Microsoft language that supports CodeView can be converted using a supplied utility and debugged using Turbo Debugger.

Neither Turbo Assembler nor Turbo Debugger package contains OS/2 versions.

Despite their positive aspects, these latest Borland offerings failed to win me over. In fact, I was puzzled to find myself hating these programs, until I realized the problem: the documentation. The TASM User Manual begins: "If you've never programmed in assembly language before, this is the place to begin." I disagree. The manuals lack even such fundamentals as a description of the CPU instruction set. Instead, you're instructed to "consult the data books provided by Intel."

Information about file types is pitiful. The structure and purpose of .EXE files isn't explained. And the most common file type (.COM) isn't mentioned until page 250—and then only in passing. The first examples of assembler programs all use simplified segment conventions, a relatively new addition to assemblers. This is confusing if you're used to the standard segments.

Both Turbo Assembler and Turbo Debugger are excellent programs. They give excellent value and can help you assemble and debug programs quickly and easily, provided that you're willing to push past the weak documentation. PC

PC MAGAZINE FACT FILE

Turbo Assembler 1.0
Turbo Debugger 1.0
Borland International Inc.
1800 Green Hills Rd.
(408) 438-8400
List Price: $149.95 (packaged together). Debugger also available with Turbo Pascal 5.0 and Turbo C 2.0.
Requires: Turbo Debugger, 384K RAM; Turbo Assembler, 256K RAM; DOS 2.0 or later.
In Short: Fast, powerful programming tools marred only by their information-stingy documentation.

CIRCLE 448 ON READER SERVICE CARD

NEC UltraLite

(continued from page 33)

firmly but quietly. On a recent airplane flight, the guy in the seat behind me sounded like a herd of mice in tap shoes as he wrote his memos. The NEC was silent.

The short travel takes a little getting used to, but the keyboard hasn't hurt my typing speed at all. Word processing users especially will be annoyed by the need to use a function-Shift key combination to get at Home, End, PgUp, and PgDn.

The UltraLite accepts an outboard 720K 3½-inch drive, accoutered in the same matte black as the machine. To use it, however, you must plug the UltraLite into its power brick/recharger. The diminutive battery pack isn't designed to spin the drive and run the machine too, hence the landline. You may never actually need the outboard drive, however, because the UltraLite sports Traveling Software's Laplink in ROM. Also in ROM is Microsoft's DOS Manager. Laplink is clearly essential. You can always find another PC in your travels, so all you have to do is carry your serial cable and a Laplink diskette with you in case your host doesn't have one.

Beyond Laplink, you'll always be in touch through the UltraLite's Hayes-compatible, 2,400-bps, built-in modem. The rear panel has RJ-11 jacks for both line and handset. I loaded up a copy of Procomm and wrung it out on MCI Mail and PC MagNet with no problems.

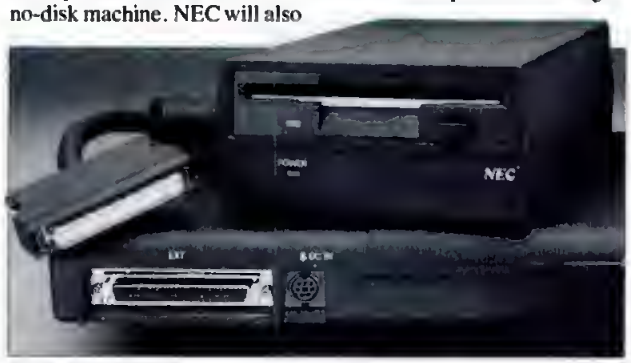
The UltraLite also sports a socket for a ROM card, addressed as the B: drive (the floppy disk drive is A:, and the RAMdisk is C:). These slim cartridges, no larger than business cards, hold up to 1MB of program. *WordPerfect* is the first of several applications to be offered on ROM cards. Buying your software this way frees up more of your RAMdisk for data, an important consideration in a no-disk machine. NEC will also custom-program ROM cards if the volume warrants it.

Is the UltraLite wonderful? Yes. Perfect? No. Battery life, at around 2 hours, is pretty good for a machine with a big backlit display and weighing only 4 pounds, 6 ounces. But NEC has made no provision for charging spare batteries externally, and it's inconvenient to open the battery access cover. The whole point of a machine in this class is traveling light. Lugging the 1.2-pound charger on an overnight trip or a day hop doesn't make it in my book. Cheap spare batteries and a tiny charger would help enormously.

I also don't understand why NEC used a cylindrical connector for the RS-232 port when a more-standard DB-9 would have fit as well. While I'm quibbling, I might as well complain about the printer port. It's out on the floppy disk drive, which means it requires the charger. That rules out being totally battery-powered with, say, a Diconix printer.

The UltraLite's few flaws are more than offset by its many advances. The technology in this machine is amazing, from the wafer-thin backlit LCD, to the keyboard, to the incredibly dense packaging within. The rechargeable-lithium-battery technology is new, too. After 5½ years, I may finally have found a DOS laptop that will cause me to retire my Tandy 100.





The 1.4- by 11.75- by 8.3-inch (HWD) NEC UltraLite boasts a receptacle for ROM cards (left), which hold 1MB of program code. The UltraLite's 3½-inch floppy disk drive (right) plugs into an AC outlet and has the system's only parallel port. NEC provides a proprietary serial cable and Laplink software for data transfer with other machines.

FACT FILE

NEC UltraLite
NEC Home Electronics
1255 Michael Dr.
Wood Dale, IL 60101
(312) 860-9500
List Price: $2,999 with 1MB RAMdisk; $3,699 with 2MB RAMdisk; optional floppy disk drive, $399.
In Short: A diskless laptop for the executive set: slim, solid, pricey. Battery life remains a problem, but this is DOS's smallest package yet.

CIRCLE **450** ON READER SERVICE CARD

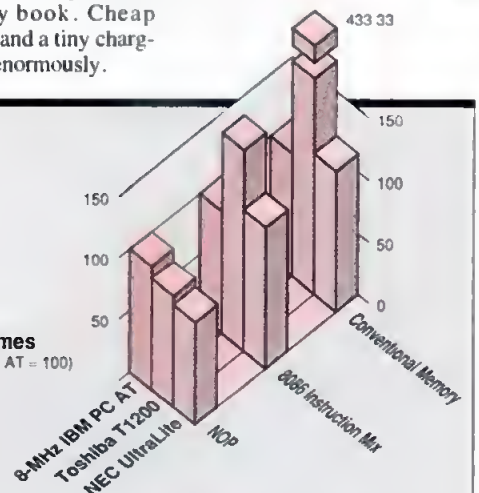
Benchmark Tests: NEC UltraLite vs. 8-MHz IBM PC AT and Toshiba T1200

The NEC UltraLite's V-30 processor and 16-bit data path give it performance approaching that of an 8-MHz IBM PC AT. The UltraLite easily outgunned the Toshiba's 80C86-based T1200 on the PC Labs tests

Performance Times
(Times given in seconds)

	NOP	8086 instruction Mix	Conventional Memory
8-MHz IBM PC AT	4.17	8.96	1.32
Toshiba T1200	3.74	14.56	5.72
NEC UltraLite	3.46	10.33	1.51

Relative Times
(8 MHz IBM PC AT = 100)



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP (No Operation) machine code instructions in a big 128K loop

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times

Model 30 286

(continued from page 33)

floppy disk drive occupies one of the bays. It seems a shame to fill the other with IBM's "Toys-R-Us" 80-millisecond hard disk.

The PC Labs benchmark tests show disappointing hard disk throughput. Even running the IBM-supplied disk cache in lower memory, the Model 30 286 only slightly betters the hard-disk throughput of an AT running without a cache. The Model 30 286 disk can't even keep up with the notoriously slow Model 50 disk.

In all fairness, disk response will seem fine when you're working with the system—as long as the cache is activated. But a true AT-speed disk operating with the same cache would improve performance considerably. The 20MB capacity of IBM's disk will also be a serious limitation for most users.

You'll find only three expansion slots in the Model 30 286, all of them 16-bit. The system board integrates circuitry for the VGA, single parallel, serial, and mouse ports, as well as a lithium-battery-backed time/date clock. You can also add an 80287 math coprocessor and upgrade the standard 512K of 120-nanosecond RAM to 4MB on the system board.

Still, it doesn't take much imagination to fill the three slots. By the time you add an external 5¼-inch drive (no pin out or ribbon cable is provided), a network adapter, and a hard disk or tape backup controller, you've pushed this machine to its limits. You can forget about additional serial or parallel ports (one of each is provided) and any memory boards you have lying around from your old AT, not to mention niceties such as fax boards and MIDI interfaces.

The 90-watt power supply could also be a limitation, but you'll probably run out of slots before you run out of power.

In the IBM tradition, the PS/2 Model 30 286 is a solidly built machine with the sleek look characteristic of the PS/2 line. If you just can't resist the attraction of the IBM logo and have been planning to buy a Model 30, buy the 30 286 instead. For a few hundred dollars more, you get 10-MHz, one-wait-state performance, AT-compatible 16-bit architecture, and full VGA support.

But if performance and useful life are more important to you than the Big Blue name, the Model 30 286's slug-fast hard disk and minimal expansion capacity make this machine a poor choice for use as anything but a limited workstation. PC

FACT FILE

IBM PS/2 Model 30 286
IBM Corp.
Contact your local authorized IBM dealer.
List Price: IBM PS/2 Model 30 286-E01, $1,995; IBM PS/2 Model 30 186-E21 (with 20MB hard disk), $2,595.
In Short: A 10-MHz, one-wait-state AT-bus system severely limited by its hard-disk performance and limited expansion capacity.

CIRCLE 449 ON READER SERVICE CARD

OS/2 Branches into Multiuser Software

On the same day IBM unveiled its PS/2 Model 30 286, OS/2 laid claim to a sizeable chunk of minicomputer turf. The newly announced PS/2 RPG (for Report Program Generator) II Application Platform and Toolkit gives IBM OS/2 the ability to run a vast body of software written for the IBM System 36.

The PS/2 RPG II Application Platform runs as an OS/2 session and manages up to eight users working on RPG II applications at remote PCs or ASCII dumb terminals. The clients are connected to the host via serial lines and need not be running OS/2. The Toolkit provides a compiler and utilities that will help developers port their System 36 programs to OS/2.

Although IBM touts PS/2 RPG II as a growth path to the System 36, that's an unlikely scenario. Instead, PS/2 RPG II gives OS/2 an instant body of multiuser applications at a time when Unix developers are attempting to exploit OS/2's single-user limitation.

Probably about 75 percent of all System 36 applications were written with RPG II. Already, more than a dozen RPG II applications are available for OS/2; most RPG II applications handle order entry or inventory tasks in specific industries, such as construction or medicine.

IBM's PS/2 RPG II requires Micro Channel hardware; California Software Products plans to introduce RPG II for PCs running OS/2 soon.

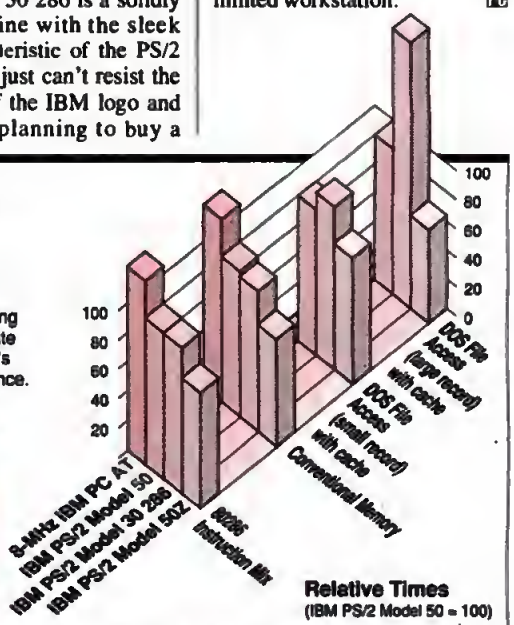
—Gus Venditto

Benchmark Tests: IBM PS/2 Model 30 286 vs. IBM PC AT and 10-MHz PS/2s

Like the IBM PS/2 Models 50 and 50Z, the IBM PS/2 Model 30 286 runs at 10 MHz, making it faster on processor-intensive tasks than the 8-MHz AT. The Model 50Z's zero-wait-state operation gives it an advantage over the Model 50 and the Model 30 286. The Model 30 286's 80-millisecond hard disk and 8-bit controller account for its disappointing hard disk performance.

Performance Times (Times given in seconds)	80286 Instruction Mix	Conventional Memory	DOS File Access (small record) with cache	DOS File Access (large record) with cache
8-MHz IBM PC AT	8.96	1.32	N/A	N/A
IBM PS/2 Model 50	7.14	1.05	55.42	12.39
IBM PS/2 Model 30 286	7.11	1.01	62.02	22.66
IBM PS/2 Model 50Z	5.60	0.77	48.09	7.96

N/A—Not applicable: the 8-MHz IBM PC AT is unable to perform these tests with caching.



The **80286 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

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CIRCLE 299 ON READER SERVICE CARD

Turbo C 2.0 Improves Speed and Adds Long-Awaited Source-Level Debugger

PC HANDS ON

BY SALVATORE P. RICCIARDI

Borland International's latest release of Turbo C redefines the state of the art in integrated development environments with a new source-level debugging facility and support for all popular memory models.

Version 2.0 includes an enhanced graphics library, new signal and raise functions, and support for long double-floating-point numbers for true 80-bit IEEE precision. Borland also increased compilation speed and, as shown by the PC Labs benchmark tests, improved execution times significantly.

Turbo C incorporates Borland's Integrated Development Environment (IDE), complete with pull-down menus and pop-up windows. The IDE seamlessly integrates a *WordStar*-compatible editor, a fast one-pass, ANSI-compatible C compiler, a source-level debugger, a Make facility, and an object file linker. You will also find context-sensitive help throughout.

The most important enhancement in Turbo C 2.0 is the integrated debugger. You can step through your source code one line at a time, trace into or past functions, set multiple breakpoints, define watch expressions for display in a watch window, search for breakpoints, and evaluate C variables and expressions. The breakpoints are "sticky"—that is, they remain intact after editing and recompiling your program.

During debugging, a scrollable "watch" window replaces the messages window. The watch window lets you watch program variables as well as C expressions. For example, you can enter the expression (i * 2) into the window and monitor new values after each program step. You can also edit watch expressions. Pressing Ctrl-Break during execution interrupts program execution and returns control to the debugger.

A smart screen-swapping feature causes the debugger to examine executing code to determine if it will modify the screen. If so, the debugger automatically swaps the debugger screen with the user screen before executing the code. If not, the swap does not take place.

The integrated Make facility includes a new auto-dependency feature. When it is turned on, Turbo C searches the file information contained in an object file to determine which source files it needs to check for currency. If any of these files have time-stamps later than that of the object file, they are automatically recompiled and linked.

Another welcome addition allows the Turbo C editor to store its edit buffer in EMS, freeing up to 64K of main memory for program code and data.

The Turbo C package includes standalone versions of the compiler, Make, Link, and several utility programs. The standalone version is required for programs that use Turbo C's in-line assembler capability. Both the standalone compiler and the IDE support all six memory models: tiny, small, medium, compact, large, and huge. The tiny model supports the creation of .COM files, which the linker can create without the intermediate EXE-2BIN step.

A particularly nice feature of this newest version is its compatibility with Borland's standalone Turbo Debugger. Source files compiled for debugging under Turbo C 2.0 can be debugged without change within Debugger. Similarly, a program compiled using the standalone compiler can be debugged using the IDE.

At press time, Borland had not announced any plans for an OS/2 version of Turbo C. But for programming under DOS, Turbo C 2.0 represents a modern, productive environment for C program development. PC

PC MAGAZINE FACT FILE

Turbo C, Version 2.0
Borland International Inc.
1800 Green Hills Rd.
Scotts Valley, CA 95066-0001
(408) 438-8400
List Price: Turbo C 2.0, $149.95; Turbo C 2.0 Professional (includes Turbo Debugger and Turbo Assembler), $250.
Requires: 448K RAM, DOS 2.0 or later.
In Short: Speed improvements and a long-awaited integrated debugger strengthen this already impressive compiler.

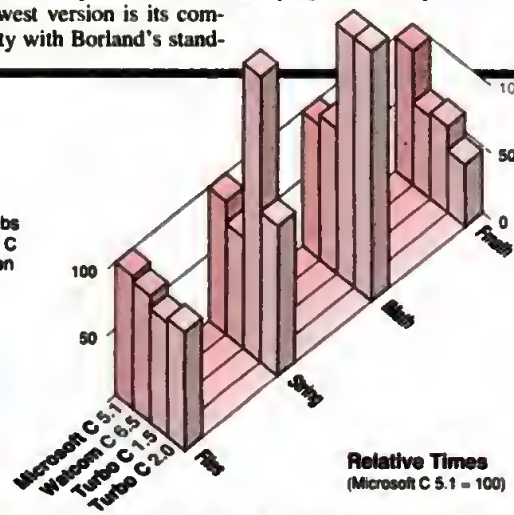
CIRCLE 444 ON READER SERVICE CARD

PC LABS Benchmark Tests: C Programs

Version 2.0 of Turbo C shows dramatic improvement over Version 1.5 on the PC Labs String and FMath benchmark programs, bringing overall execution speed of Turbo C files closer to that of the front-runners. As in the past, Turbo C compiles files in a fraction of the time required by Microsoft C and Watcom C (compilation times not shown).

Performance Times

(Times given in seconds)	Files (execution time)	String (execution time)	IMath (execution time)	FMath (execution time)
Microsoft C 5.1	112.2	53.2	82.0	301.5
Watcom C 6.5	106.9	44.3	88.4	183.1
Turbo C 1.5	96.4	113.4	153.4	192.3
Turbo C 2.0	100.2	59.9	153.3	139.9



The **Files** benchmark program tests a C compiler's file-handling abilities. A compiler's level of performance on this test results both from its ability to optimize file-handling code and from the file-handling efficiency of its runtime library.

The **String** benchmark program tests a C compiler's ability to optimize string operations and the string-handling performance of the routines in its runtime library. It attempts to use most of the string operations found in a typical C program.

The **IMath** benchmark program tests a C compiler's ability to optimize standard integer math operations. The test attempts to simulate the integer math operations performed in a variety of C program contexts.

The **FMath** benchmark program tests a C compiler's ability to generate optimal floating-point math code, based on the compiler's ability to optimize floating-point operations and the efficiency of its floating-point library routines.

For a complete description of the PC Labs C Compilers benchmark tests, see *PC Magazine*, September 13, 1988, pages 162–164.



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Here's how to make Software Carousel work for you.

Software Carousel is the amazingly easy way to switch almost instantly from WordPerfect to 1-2-3 to dBASE to DOS to whatever else you want. Or go from one file to another in the same program. All without saving or retrieving – or wasting a precious moment of your time. Or your computer's memory.

It works by creating a number of independent software slots to load your programs into. You get up to ten of these software slots, so you can load up to ten programs.

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Look for Software Carousel at software dealers everywhere. Or order direct from SoftLogic Solutions by calling us toll-free. If, after thirty days, you're not satisfied that Software Carousel is the right way to get that old PC technology off your back, we'll gladly arrange for a refund of your purchase price.

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–Ralph Evans, Attorney, Fullerton, CA

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–Colm Ralph, Ralph & Panzer, Inc., Seattle, WA

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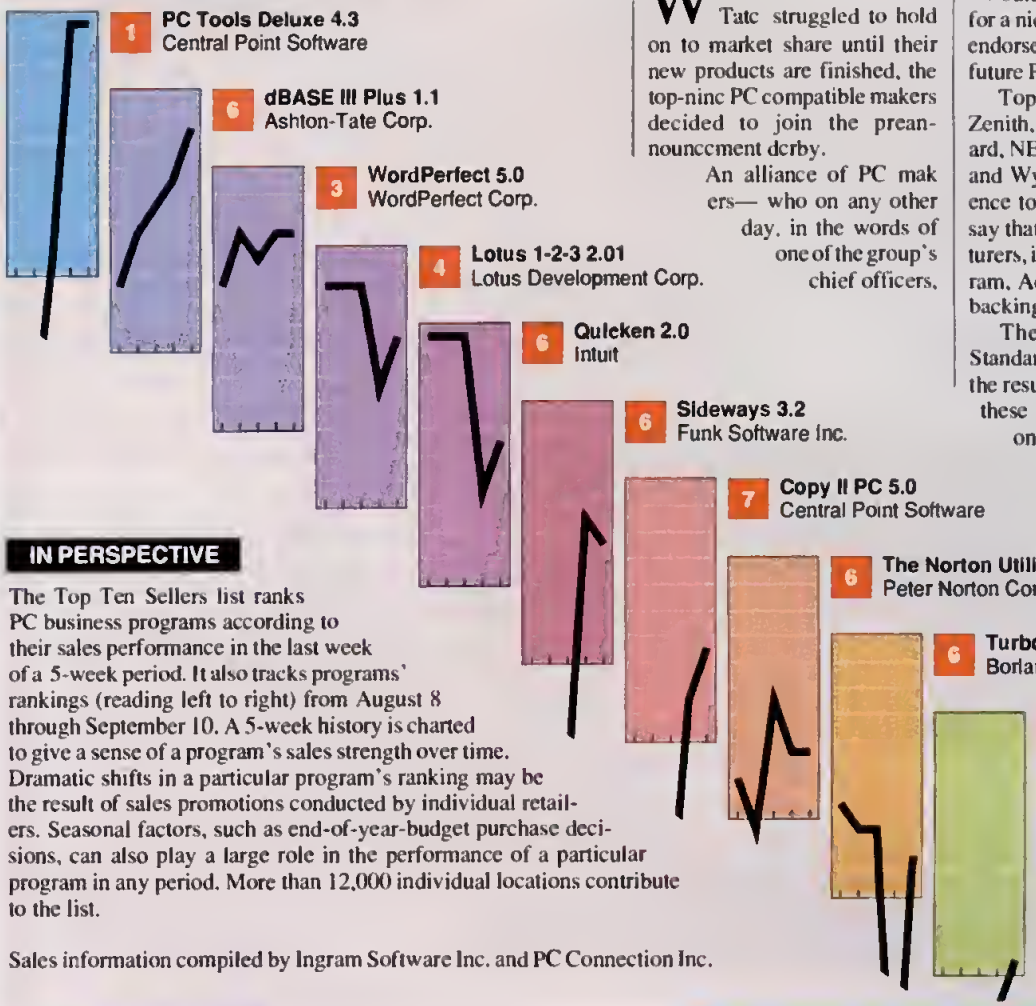
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CIRCLE 334 ON READER SERVICE CARD

PC MAGAZINE PIPELINE

TOP TEN SELLERS

(A 5-week history)



IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from August 8 through September 10. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc. and PC Connection Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

While Lotus and Ashton-Tate struggled to hold on to market share until their new products are finished, the top-nine PC compatible makers decided to join the preannouncement derby.

An alliance of PC makers— who on any other day, in the words of one of the group's chief officers, "would cut one another's throat for a nickel" —joined forces to endorse a new 32-bit bus for future PCs.

Top officials from Compaq, Zenith, Tandy, Hewlett-Packard, NEC, AT&T, Epson, AST, and Wyse held a press conference to show solidarity and to say that major add-in manufacturers, including Iomega, Quadram, Adaptec, and Arnet, were backing them up.

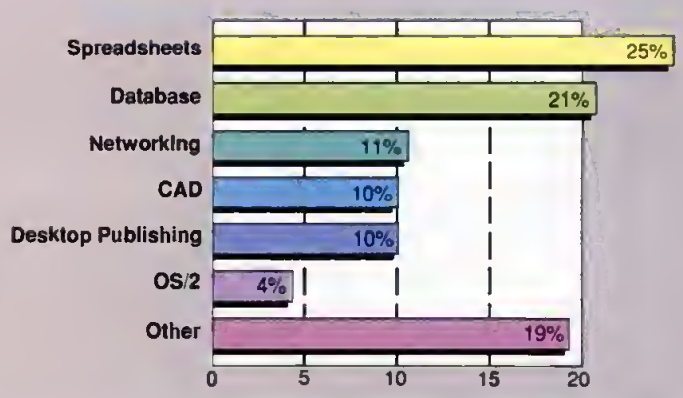
The Enhanced Industry Standard Architecture (EISA) is the result of discussions among these PC makers and is still only a proposed specification: hardware will not be finished until the middle of next

PC MAGNET SURVEY

In light of the recent RAM crisis and conflicting add-in card standards, we thought it would be interesting to see what callers to PC MagNet are doing with add-in memory. Out of 1,100 respondents, 76 percent said they added a memory board to either their own PC or a PC used elsewhere at their company.

PC MagNet is an on-line service run by the editors of *PC Magazine* through the CompuServe network; surveys are posted there regularly.

For which application did you buy add-on RAM?



year and might very well not be on sale until late 1989, if ever. Of course, as engineers put the finishing touches on the spec in coming months, market researchers will attempt to determine if the users are going to buy this, the second 32-bit architecture for PCs.

Why EISA?

Although the technical need is compelling, this alliance may well be a reaction to IBM's latest sales successes with the MCA (Micro Channel architecture). Sales of MCA-based IBM PS/2s had trailed behind sales of the classic bus-based Models 25 and 30 until very recently. In early September, though, the tide started to turn: market surveys from Storeboard in Dallas showed that the MCA-based PS/2s were outselling IBM's other PS/2s for the first time.

There are other factors behind the EISA alliance. IBM announced another old-bus PS/2, the Model 30 286 (see page 33), providing market ammunition for those who believe the Micro Channel architecture will never be accepted. And, at the same time, IBM has attempted to extract hefty royalties from anyone who sells an MCA-based product not only on sales of those machines but on sales of earlier PCs as well. "U.S. manufacturers aren't willing to be subsidiaries of IBM," said one EISA-backing executive.

The secrets to this new architecture are available to anyone willing to sign a nondisclosure agreement and to pay a fee of $2,500 to the Washington, D.C.–based law firm that's administering the program. In return, registrants will receive full documentation, upgrades, and access to an EISA bulletin board.

EISA will have an automatic configuratiun system (similar tu the PS/2's programmable option selector, ur POS), so EISA add-in cards will need a unique identifier but won't need DIP switches. Unlike IBM's tightly controlled POS allocation program, the EISA guidelines for identification center on I/O port assignments to avoid conflicts and have already been published, so a manufacturer can select its own number; if two cards in the same PC had the same number, it would indicate a port conflict that needed to be resolved through a device driver.

The heart of EISA will be Intel-bus-control logic; these chips, which are still in the works, will provide bus mastering, including bus arbitration; automatic 8-, 16-, or 32-bit data path translations; and support of DMA (direct memory access) transfers at rates as high as 33 megabytes per second. There'll be 32-bit addressing for DMA; existing 16-bit DMA devices will be ahle to work in 32-bit mode with the help of device drivers or to run unchanged in 16-bit mode. There will also be four DMA cycles: 4, 5.3, 8, or 33 megabytes per second; the Micro Channel architecture has a top speed of 20 megabytes per second.

EISA will provide both edge- and level-triggered interrupts. Edge-triggered interrupts are the only kind available in classic bus PCs and give programmers an on-or-off access to interrupts; level-triggered interrupts will let programmers maintain several states of an interrupt, so a communications or hard disk transfer can be shared by different devices.

Bus arbitration will automatically assign access to system resources on a rotation, but it can be programmed to grant higher priorities to devices or processors.

Good News fur IBM?

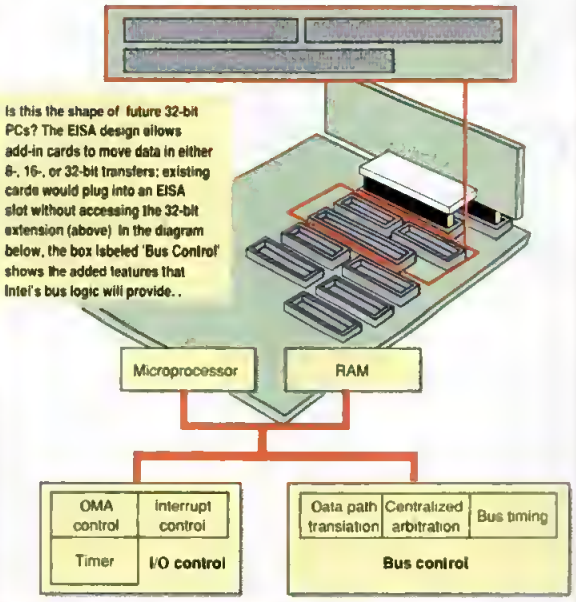
It's natural to see the EISA alliance as a threat to IBM and its two-legged PS/2 strategy. The greater risk, however, is to the sales of the alliance's 386 PCs for the next year. IBM was handed an excellent selling point, and unfamiliar as the words may be to the voices of IBM's salespeople, they will be telling fence-sitting customers "we have it *today*." Meanwhile, EISA-backing manufacturers have to convince people that their current 386 PCs are *not* obsolete. Since IBM never put a 386 in a 16-bit box, its position is far more rational: if you don't need a 32-bit bus, take the Model 30.

EISA's promise may make people more relaxed when buying add-in cards, but IBM claims its research shows few people put old cards in new systems. Individual users may do lots of swapping, but corporate buyers rarely bother.

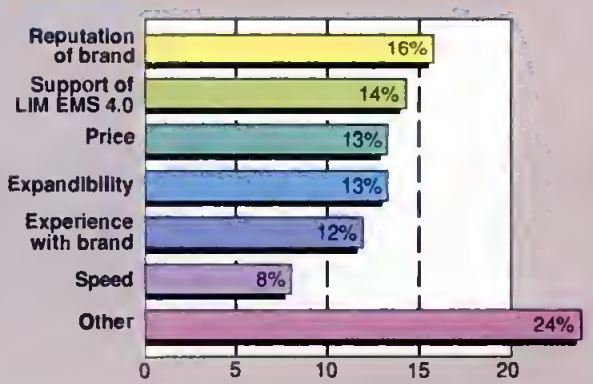
The EISA backers have shown lots of courage in putting their necks out to advance the state of the PC; expect to see some impassioned pleas for your support until they deliver.

—Gus Venditto

The Proposed EISA 32-Bit PC Bus



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CIRCLE 264 ON READER SERVICE CARD

Relational Database Applications In Turbo Pascal or C Source Code

PC HANDS ON

BY NEIL J. RUBENKING

Code generators are a dime a dozen. Some do screens, some do menus, but few do everything you want them to. *Dotoboss*—in both its versions, *Dotoboss Poscal Generotor* and *Dotoboss C Generator*—is an exception. It turns out complete applications with nearly all the features of major database products.

Dotoboss generates tree-structured relational database files, data entry screens, menus, reports, password security modules, data import/export programs, video and printer installation modules, and even recovery programs for corrupted indexes. It also writes programmer documentation for the entire application.

The resulting programs require a BTRIEVE-like B+ Tree handler, but you can distribute the handler and compiled applications with no license fee.

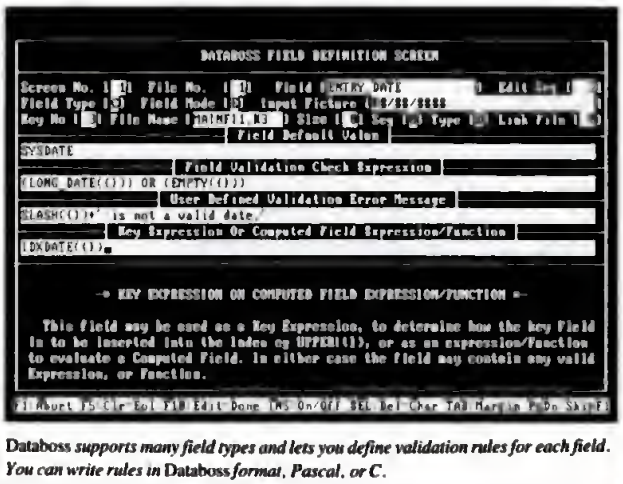
The *Dotoboss* input screen painter has the expected features—boxes, colors, and so forth. A field-definition module places various types of fields on the painted screen.

Databoss allows normal editable fields, calculated fields, display-only fields, auto-incrementing fields, and lookup fields, and it lets you define default values and validation rules for each field.

Databoss menus are utilitarian. Each is a full screen displaying up to 38 options. The options can include other menus, application modules, DOS commands, batch files, and even external programs.

You can create a wide variety of reports with the *Databoss* report generator, provided you have the patience. You must draw your report on paper and make a separate entry in the generator for each label and field. Reports can have multiple levels of headers, detail items, and footers and as many as 999 subtotals.

Programmers will appreciate the control they have over *Databoss*'s output. At the simplest level, it's possible to edit the generated code, but such changes will disappear if you use *Dotoboss* to generate again. There are better methods.



Databoss supports many field types and lets you define validation rules for each field. You can write rules in Databoss *format, Pascal, or C.*

PC MAGAZINE FACT FILE

Databoss Pascal Generator
Databoss C Generator
Top Gun Systems
4 Cottage Ave.
Mill Valley, CA 94941
(415)388-9009
(800)323-7767
List Price: $399 each.
Requires: 256K RAM (512K RAM recommended); DOS 2.0 or later; Turbo Pascal 4.0 or later (for *Pascal Generator*), Turbo C (for *C Generator*). Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

First, you can incorporate files of your own code either as user-defined functions or as initialization or exit code. Second, you can modify the "skeleton" files from which *Dotoboss* builds applications. This method requires programming expertise, but it lets you completely change the kind of code *Databoss* generates.

Databoss is a new product, and its user interface is still a bit rough. The manual needs editing, the report generator is unwieldy, and there are no ad hoc queries. But few business applications really need ad hoc queries, and the programs *Databoss* generates run smoothly. PC

Word 4.0 Help Screens That Really Help

PC HANDS ON

BY EDWARD MENDELSON

If you've given up trying to get help from *Microsoft Word*'s help screens, help is on the way.

Rinearson Support Associates' *Microsoft Word 4.0 Companion Disk* is a $19.95 cornucopia of help screens, macros, and patches for *Word* 4.0. And it throws in an improved LaserJet driver and a *WordStor* file-conversion program for good measure.

The *Companion Disk*'s help file completely replaces *Word*'s laconic and unhelpful one. The disk's 80 editing macros let you press two keys to do just about anything you want, from drawing boxes around a group of paragraphs, to printing the current page, to compiling a table of contents.

The *Companion Disk*'s help screens give users of Version 4.0 the clarity and comprehensiveness that Peter M. Rinearson's classic book *Word-Processing Power with Microsoft Word* (Microsoft Press) brought to users of Version 3.1. The screens explain how to type keystrokes and instructions in *Word* macros and how to search and replace special characters like paragraph and division marks—topics that *Word*'s own help screens never heard of.

You still have to page your way down through a stack of as many as 14 screens to find what you want, but that's an inconvenience imposed also by *Word*. For some important screens, Rinearson includes macros that flip to the right page faster than a cardsharp can flip through a deck.

Rinearson's most spectacular macros let *Word* display dark characters on a light background, or imitate a green or amber monitor on an EGA or VGA, or use any of 60 colors for text modes, such as italic. PC

PC MAGAZINE FACT FILE

Microsoft Word 4.0 Companion Disk
Rinearson Support Associates
219 First Ave. North, #410
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(206) 824-4132
List Price: $19.95
Requires: 320K RAM, *Microsoft Word* 4.0, DOS 2.0 or later.

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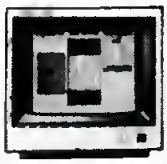
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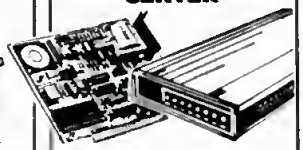
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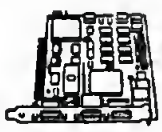
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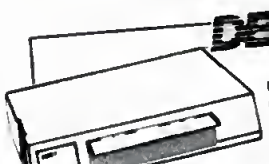
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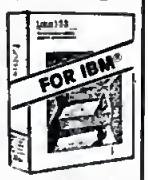
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CIRCLE 254 ON READER SERVICE CARD

Panasonic Packs Six Typefaces and High-End Paper-Handling into Its $530 24-Pin Printer

PC HANDS ON

BY JONATHAN MATZKIN

If you want some insight into why Japan has the strongest economy in the world, take a hard look at the Panasonic KX-P1124. There's no earthshaking new technology incorporated in this 24-pin dot matrix printer, but its $529.95 list price buys you just about everything you could possibly want from a low-end 24-pin dot matrix. To its wealth of features add compact dimensions (5 1/16 by 16 1/2 by 14 inches, HWD), and carefully engineered ease of use and you've got yourself a formidable competitor in the desktop printer wars.

The narrow-carriage KX-P1124 has six built-in typefaces. In addition to the commonly found draft and NLQ (near-letter-quality) Courier typefaces, there are Bold Proportionally Spaced, Prestige, and sans serif fonts; all of them are quite attractive. There is also an elegant script font, one of the few I've seen that is more than just a gimmick.



The Panasonic KX-P1124, at $530, has just about everything you could want from a low-end, 24-pin dot matrix printer, including compact dimensions.

The overall print quality of the KX-P1124 is about what you would expect from a low- to moderately priced 24-pin machine. Its NLQ characters are definitely suitable for correspondence and reports but not up to the near-typeset-quality output of lasers and the best ink jet printers. In draft mode the KX-P1124 put out a peak noise level of 73 decibels.

In our speed tests, the KX-P1124 clocked in at 86 characters per second in draft mode. That won't set any records, but it places the machine solidly among its price competitors.

Ease of use is where the KX-P1124 leaves the competition at the starting line. Virtually all of the printer's important features—including typefaces, font sizes, form length, and margins—can be easily selected from the KX-P1124's ingenious front control panel. The panel controls the printer so completely that Panasonic has done away with DIP switches.

The control panel takes a little getting used to, but after stepping through the selection process a few times with the aid of the manual, you should be able to choose features without help of the documentation. The panel consists of a row-and-column feature grid; you press the appropriate buttons until the cell that contains the desired feature is selected.

In addition to allowing easy selection of features, the panel lets you specify power-up defaults. For instance, if you want emphasized sans serif to be your default font, you can easily choose that option with a few taps of the panel buttons. Three control-panel "macros" let you store groups of features that can be invoked with a simple key sequence.

Panasonic supplies a quick reference card that, like the rest of the manual, is a vast improvement over the useless documentation that accompanies most printers.

The language is clear and concise, and diagrams actually help rather than confuse. My only complaint is with the index, which lacked references for several topics I looked for. But a little hunting invariably turned up what I needed.

The KX-P1124 answers most paper-handling questions with aplomb. For pull-tractor operation, paper can be loaded through either a front or bottom slot; the push-tractor accommodates paper through a rear slot. The front slot accommodates cut sheets up to 11.7 inches wide, thus allowing printing in landscape orientation. Switching pull and push tractors is a simple matter that's clearly outlined in the manual.

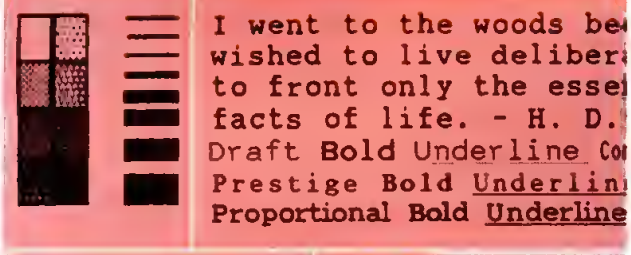
The push tractor smoothly and automatically loads paper to the very top of the first sheet. The paper-parking feature allows printing of cut sheets without unloading continuous forms.

The overall intelligence of its design sets the Panasonic KX-P1124 well apart from most of its competitors. Panasonic has done again what it first accomplished with its marvelous 9-pin dot matrix machine, the KX-P1091i. The manufacturer has brought a large bundle of features together with solid performance and very good print quality, all at an easy-to-swallow price. That's a difficult combination to top.

List Price: Panasonic KX-P1124, $529.95. Panasonic Industrial Co., Computer Products Division, Two Panasonic Way, Secaucus, NJ 07094; (201) 348-7000.

CIRCLE 445 ON READER SERVICE CARD

Panasonic KX-P1124



Type: 24-pin impact matrix
Carriage width: 11.7 inches
Price: $529.95

SPEED (cps):
Rated: 160
Default: 86

TYPE PITCHES (cpi): 5, 6, 7.5, 8.5, 10, 12, 15, 17, 20

SOUND LEVEL (decibels):
Tested: 73

FEATURES:
Printing: Bold, double-strike, correspondence quality, super/subscript, underline
Formatting: Centered, double-high, horizontal tab, vertical tab, justified, proportional space, variable form length, variable line height

COMPATIBILITY:
IBM character set: Low and high
Graphics: Epson LQ-2500, IBM Proprinter X24
Text: Epson, IBM

Photograph: Thom O'Connor

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A Full-Featured Windows Scrapbook

PC HANDS ON

BY STEVE ROTH

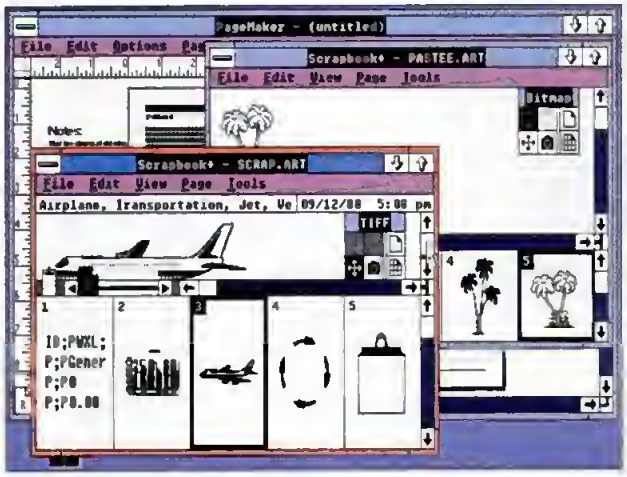
If *Microsoft Windows* really is the Macintosh clone that Apple would have us believe, then you would expect it to include software tools like a scrapbook where you can cut and paste multiple items and store them permanently. Microsoft still doesn't provide a scrapbook, but now T/Maker's *Scrapbook Plus* does. While the *Windows* clipboard can store only one item at a time, *Scrapbook Plus* lets you create, load, and save multiple scrapbook files, each with up to 4,500 items, or "pages" (limited by memory). You can view the pages as thumbnails or in full-page view, attach descriptions to each page, and search for pages using keywords.

Scrapbook Plus can handle bitmaps, pictures (*Windows* metafile), .TIF, Encapsulated PostScript (.EPS), text, ricb text (.RTF), printer pictures and printer bitmaps, and three data formats—SYLK, .CSV, and .DIF. To build a scrapbook file, you either paste the items in or import a whole batcb at once from disk files. You multiple-select the files in the Import dialog box, and *Scrapbook Plus* does the rest, optionally deleting the source files after import. *Scrapbook Plus* does not import *Paintbrush* .PCX files or any of the Micrografx formats, so you have to cut and paste those images into a scrapbook file or convert them.

With *Scrapbook Plus*'s AutoPaste option on, everything that is cut or copied to the clipboard is pasted into the current scrapbook file. You can run multiple copies of *Scrapbook Plus*. The Export feature lets you save any item as a disk file.

Considering that it runs under *Windows*, *Scrapbook Plus*'s speed is impressive. It loads a scrapbook file almost instantly, no matter the size (a 4MB file loaded as fast as a 4K one), and it took less than 15 minutes to import 127 .EPS images on a 12-MHz AT clone.

For those who use multiple applications under *Windows* and who want a vehicle for moving information among those applications, *Scrapbook Plus* is a winner. It works quickly and reliably, and it moves *Windows* a big step closer to the functionality of the Mac. PC



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PC MAGAZINE FACT FILE

Scrapbook Plus
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1973 Landings Dr.
Mountain View, CA 94043
(415) 962-0195
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Requires: 256K RAM, *Microsoft Windows* 2.03, 286, or 386 (either runtime or standalone), DOS 2.0 or later. Not copy protected.

CIRCLE 433 ON READER SERVICE CARD

Battle of the LaserJet Supercartridges

PC HANDS ON

BY EDWARD MENDELSON

The struggle for the cartridge slots on America's LaserJets is growing fierce. A few months ago IQ Engineering launched its capacious Super Cartridge 1, with 55 fonts crammed into a single package currently priced at $499. Now Pacific Data Products, using a slightly different battery of fonts, fires back with its $399 25-in-One! cartridge. The Pacific Data cartridge is cheaper, but whether it's better is an open question—unless you use the original LaserJet. Contrary to Pacific Data's advertised claims, the 25-in-One! doesn't work with the LaserJet.

Both cartridges emulate about 20 Hewlett-Packard cartridges, with varying sizes of Times Roman, Helvetica, Courier, Elite, Presentation, Letter Gothic, Math, and Line Draw fonts. Both come with .PRD files for *Microsoft Word*.

The IQ Engineering model works with any software that knows how to control standard HP cartridges. Pacific Data, in contrast, doesn't fully match HP's font selection strings, so applications that expect to find an HP cartridge won't always work with Pacific Data's. If you tell *WordPerfect* 5.0 to print a landscape page in Helvetica, Letter Gothic, or Prestige Elite using the Pacific Data cartridge, you'll get nothing but the tiny Line Printer font instead. Unless you're ready to modify obscure command strings in your applications, most of Pacific Data's landscape fonts, and some portrait fonts, may be useless to you.

The IQ Engineering manual is virtually an entire encyclopedia of LaserJet font lore. Pacific Data's sparser manual uses symbol charts copied from one of Hewlett-Packard's font catalogues.

Both cartridges include diminutive fonts for spreadsheets—IQ Engineering with both 4-point Letter Gothic and 5-point Line Printer, Pacific Data with a 4.8-point size of Xiphias's AFS special spreadsheet font. IQ Engineering includes an Optical Character Reader font not in Pacific Data. Pacific Data adds 18-point Presentation portrait and 10-point Times Roman landscape (no italic) to the IQ Engineering roster. Although Pacific Data includes the tax line-draw font omitted by IQ Engineering, Pacific Data makes the font virtually unusable, by omitting the text font that goes with it.

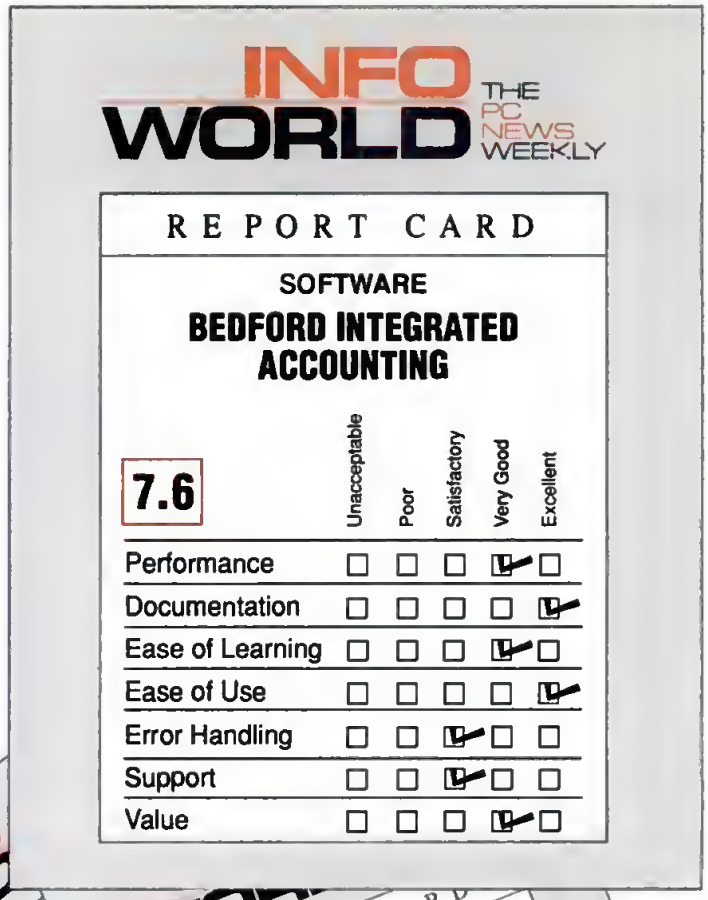
Pacific Data Products' 25-in-One! cartridge packs a lot of fonts in a small, inexpensive package. IQ Engineering's Super Cartridge 1 costs more, but it's a better-designed, better-documented product that produces a better-looking page. PC

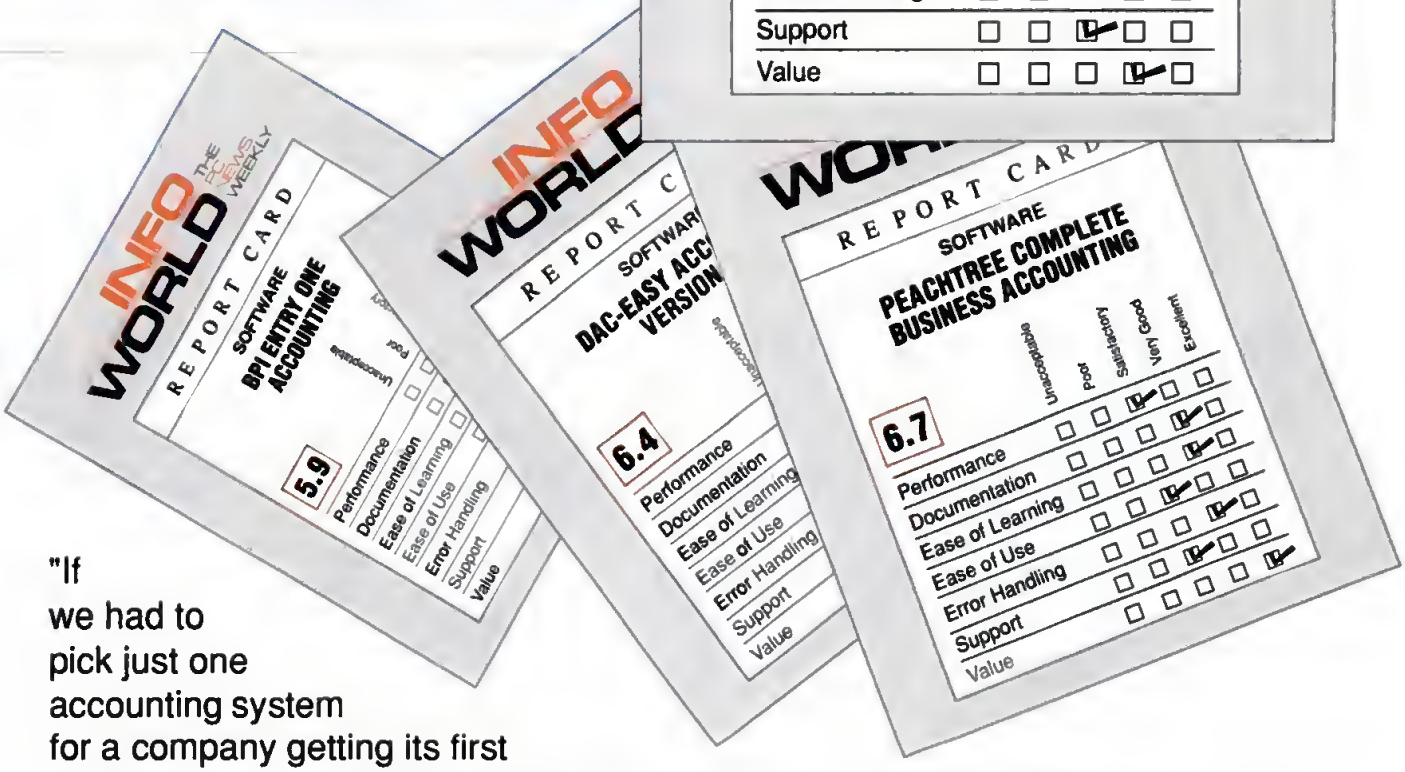
PC MAGAZINE FACT FILE

25-in-One!
Pacific Data Products
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San Diego, CA 92121
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- Norton SI rating equals 27

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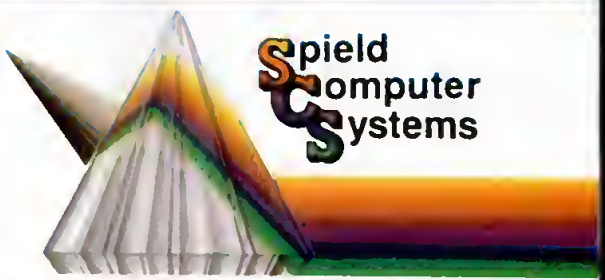
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- Clock Calendar with battery backup.
- 101 Enhanced Keyboard
- Western Digital 2F-2H Controller
- 1.2MB Floppy Disk Drive
- AT and OS/2 Compatibility
- 220 Watt Power Supply
- Socket for 80287 (daughter card for 80387)
- One 32 Bit Slot, Five 16 Bit Slots, Two 8 Bit Slots.
- Norton SI rating equals 20.5.

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NEW ON THE MARKET

by Jonathan Matzkin

Procom Technology Brings Tape, Floppy Drives to the Laptop

Laptop computers are becoming as ubiquitous as luggage, and **Procom Technology** offers two external peripherals to increase the productivity of DOS-on-the-go. The $750 Procom PLT40 is a 40MB (formatted) tape drive, and the $395 Procom PLF360 is a 360K, 5¼-inch floppy disk drive. Both units attach to the laptop's external floppy disk drive port and are compatible with all Toshiba laptops, the NEC HD series, and Zenith portable computers.

The PLT40 affords laptop users the same data security that they get from tape drives for their desktop machines. The external subsystem has a data transfer rate of 250 kilobits per second and uses the DC2000 tape cartridge. The tape format is compatible with Archive, Alloy, and Wangtek hardware, and tapes can be used interchangeably by any of these three systems.

List Price: Procom PLT40, $750. **Requires:** DOS 3.2 or later, compatible laptop with external floppy disk drive port. **List Price:** Procom PLF360, $395. **Requires:** DOS 3.2 or later, compatible laptop with external floppy disk drive port. Procom Technology Inc., 200 McCormick Ave., Costa Mesa, CA 92660; (714) 549-9449.

CIRCLE **438** ON READER SERVICE CARD



Procom Technology has introduced two peripherals, a tape backup unit ($750) and a 360K, 5¼-inch floppy disk drive ($395), for use with laptops.

TSR Spreadsheet Is 1-2-3 Compatible, Occupies 12K RAM

Numbers Up, from **Mindscape Inc.**, is a pop-up spreadsheet that occupies only 12K RAM, yet can hold spreadsheets that are as large as 64 columns by 999 rows. The $79.95 *Lotus 1-2-3*–compatible TSR minimizes RAM use by swapping either to LIM 4.0 memory or to your hard disk.

The spreadsheet reads and writes both .WK1 and .WKS formats, and Mindscape says that the *Numbers Up* command structure has been "designed with the *1-2-3* user in mind." You can vary the width of an entire column or any cell or range of cells. *Numbers Up* also supports keyboard macros and has context-sensitive help.

Also, *Numbers Up* has a cut-and-paste feature that lets you move numbers and text between any two programs. According to Mindscape, *Numbers Up* recognizes word processors, databases, and spreadsheets, and correctly formats pasted data for each application.

List Price: *Numbers Up*, $79.95. **Requires:** 256K RAM, DOS 2.1 or later. Copy protected. Mindscape Inc., 3444 Dundee Rd., Northbrook, Il 60062; (312) 480-7667.

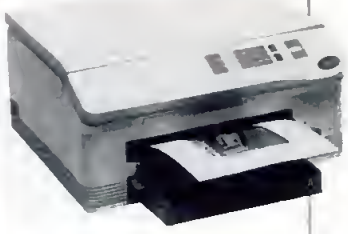
CIRCLE **442** ON READER SERVICE CARD

Color Printers Offer Both High Resolution And Video Interfaces

New printers from **Mitsubishi Electronics America** and **Seiko Instruments USA** offer users a choice of color output devices.

The Mitsubishi G330 is a color thermal graphics printer that sports a built-in video interface for faster output. It prints on A-size glossy paper or transparencies and is targeted at business graphics and CAD uses.

The $5,900 printer generates 150-dot-per-inch (dpi) output in approximately 80 seconds. It uses dithering and color mixing to produce up to 4,096 hues from seven basic colors. The video interface captures video signals directly from the IBM CGA, EGA, or VGA, and a screen-dump capability allows the printer to output an image of anything viewable on a CRT. The G330 measures 8.6 by 16.9 by 16.5 inches (HWD) and weighs 42 pounds.



Mitsubishi's G330 thermal color printer ($5,900) has a video interface that allows it to print virtually any CRT image from a CGA, EGA, or VGA adapter.

Seiko's color printers come in two basic models. The CH-5504 prints A-size pages, while the CH-5514 produces A- or B-size output, and both generate 300-dpi output. The two units are available in a variety of configurations, starting at $5,995 for the CH-5504 with a parallel interface and ranging up to $14,995 for the CH-5514 with a video interface. Three different video interfaces are available.

(continues on page 52)

HOT PROSPECT

Xerox Enters Graphics Market With Windows-based Program

Xerox Presents is intended to bring Macintosh-like presentation graphics to the PC, just as **Xerox**'s *Ventura Publisher* brought Mac-like desktop publishing power to the IBM environment. *Xerox Presents* ($495), which runs under *Microsoft Windows*, was developed by Cricket Software, previously known for Mac presentation graphics and drawing packages.

The graph creation facility allows for extensive layout control, table manipulation, and interchangeable graph types. *Presents* supports object-oriented clip art and has drawing tools for objects ranging from straight lines to adjustable polygons. The 256-color palette supports gradient shading.

Presents includes more than 200 style sheets for word charts, tables, graphs, diagrams, and images. You can modify existing style sheets to suit your needs or start from scratch and define your own.

Bitstream's *Fontware* and eight typefaces are included, along with a full-featured word processor.

Presents imports a variety of file formats, including ASCII text, most spreadsheet files, *Windows* metafiles, TIFF files, .PCX files, and Encapsulated PostScript files.

List Price: *Xerox Presents*, $495. **Requires:** 640K RAM, hard disk, DOS 3.1 or later. Not copy protected. Xerox Corp., P.O. Box 24, Rochester, NY 14692; (800) TEAM-XRX, ext. 125E.

CIRCLE **435** ON READER SERVICE CARD

NEW ON THE MARKET

Color Printers

(continued from page 51)

The CH-5504 prints A-size pages at a rate of 55 seconds per page. The CH-5514 puts out a B-size page in 65 seconds. They both print on either paper or transparency film.

List Price: Mitsubishi G330, $5,900. Mitsubishi Electronics America Inc., Computer Peripherals Division, 991 Knox St., Torrance, CA 90502; (213) 515-3993.

CIRCLE **440** ON READER SERVICE CARD

List Price: CH-5504, from $5,995. CH-5514 with video interface, $14,995. Seiko Instruments USA Inc., 1130 Ringwood Ct., San Jose, CA 95131; (408) 943-9100.

CIRCLE **441** ON READER SERVICE CARD

Software Publishing Expands the PFS Software Line with Low-End Graphics

The company that brought you *Harvard Graphics* has added a low-end presentation graphics program to its "*First*" software line. **Software Publishing** says *PFS:First Graphics* ($149) has many of *Harvard Graphics*' features; it is intended for the user who occasionally wants to add business graphics to spreadsheet, database, or word processing output.

The software produces such basic visuals as text, bullet, pie, bar, and line charts, and it also handles 3-D graphs. Charts can have mixed bars, lines, pies, and columns. In addition, you can generate overlapped bar and cumulative charts.

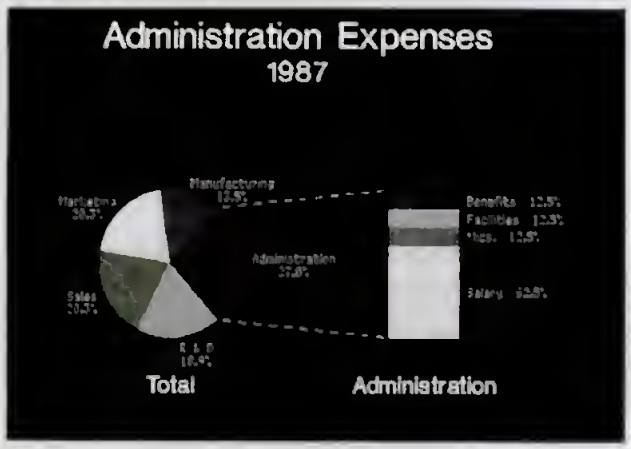
PFS:First Graphics has five built-in fonts along with hundreds of type sizes, according to Software Publishing.

The charting package reads *Lotus 1-2-3* and ASCII files and exports charts to *PFS:Professional Write* and *Harvard Graphics*. In batch mode, *PFS:First Graphics* can print or plot groups of charts.

Printer support includes drivers for PostScript and color printers. *PFS:First Graphics* also supports printers by Epson, IBM, Okidata, and Tandy, among others, and plotters by Hewlett-Packard, IBM, and Houston Instrument.

List Price: *PFS:First Graphics*, $149. **Requires:** 320K available RAM, graphics adapter, DOS 2.0 or later. Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039; (415) 962-8910.

CIRCLE **436** ON READER SERVICE CARD



PFS:First Graphics, new from Software Publishing ($149), is intended for occasional graphics users who want to add spiffy visuals to their output

Single-Slot Add-in Board Offers Disk Backup, Security, and Fault Tolerance

Fifth Generation Systems, maker of the popular *Fastback* backup utility, has introduced an add-in card that might be called "peace of mind in a single slot." Dubbed the Counterpart, it will automatically and continuously back up data written to a hard disk onto a secondary hard disk. A failure of the primary drive results in an automatic switch to the secondary drive.

As another option, the $495 half-card will perform automatic periodic backups. These backups are incremental and apply only to disk tracks that have changed since the last periodic backup. An audible alarm is triggered by failure of the primary hard disk, prompting the user to switch disks. All data that is saved by the periodic backups will then be available. A user can also elect to override the periodic backup schedule and invoke an immediate backup.

The Counterpart also provides password security for floppy disk drives and physical and logical hard disk drives. This feature includes data encryption and user-changeable passwords. Password control can be set for read-only, read/write, or no access.

List Price: Counterpart, $495. **Requires:** 8- or 16-bit half slot, second hard disk, DOS 2.0 or later. Fifth Generation Systems Inc., 11200 Industriplex Blvd., Baton Rouge, LA 70809; (504) 291-7221.

CIRCLE **437** ON READER SERVICE CARD

Board Maker Debuts 2,400-bps Modem Card For the Micro Channel

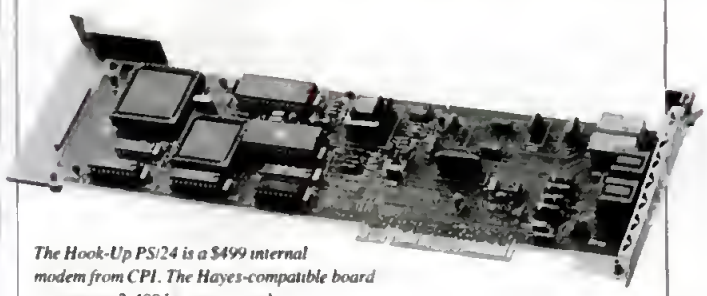
There has been much discussion about the willingness of board makers to produce add-ins for the Micro Channel architecture. There isn't yet an avalanche of products, but boards are appearing in steadily increasing numbers.

Computer Peripherals has unveiled the Hook-Up PS/24, a 2,400-bit-per-second internal modem for the Micro Channel that offers IBM-authorized ID numbers.

The $499 modem—the company's first PS/2-compatible telecommunications product—is compatible with the Hayes Smartmodem Model 2400B and supports the industry standard extended AT command set. The Hook-Up PS/24 is configurable as COM1 through COM8 and boasts automatic fallback to 1,200-bps operation.

List Price: Hook-Up PS/24, $499. **Requires:** Micro Channel expansion slot. Computer Peripherals Inc., 667 Rancho Coniho Blvd., Newbury Park, CA 91320; (805) 499-5751.

CIRCLE **439** ON READER SERVICE CARD



The Hook-Up PS/24 is a $499 internal modem from CPI. The Hayes-compatible board operates at 2,400 bits per second

FASTMICRO

ORDER LINE: 1-800-441-FAST

SPECIALS

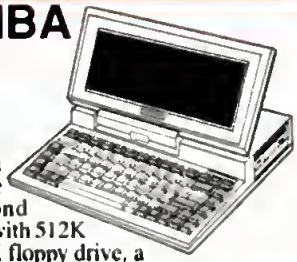
WordPerfect 5.0



$215
List $495

The most popular word processor is now even better than ever! Version 5.0 adds multiple font support, graphics integration, page preview and much more. WordPerfect 5.0, still retains its feel and ease of use that made it #1. Combine this with the best support in the industry and you can't lose.

TOSHIBA T1000 $749



The Toshiba T1000 is the perfect second PC! It comes with 512K of ram, a 720K floppy drive, a supertwist LCD screen and MS-DOS in rom! All this in a battery-powered 7 pound package. A 768K ram card is just $269 and can be set as base, expanded, or a non-volitile ram disk.

TOSHIBA Printers



These 24 pin models are loaded with features and are priced right. You can select multiple fonts and pitches right from the menu-driven front control panel. With paper parking, you can insert a single sheet without removing the continous form paper. All this and multiple emulations with no dip switches.

P321SL Narrow $459
P341SL Wide $629

HARDWARE

PRINTERS

	LIST	FAST
Citizen		
120D	229	145
180D	259	165
MSP40-55		Call
Tribute 124	699	449
Tribute 224	949	599
Diconix		
150P	499	299
Epson		Call
Fujitau		
DL3400	995	549
NEC		
P2200	569	339
P5200	799	509
P5300	1049	669
P5XL	1295	Call
LC890	4799	Call
Okidata		
182 Plus	319	219
292 (Req Intsrface)	539	349
320	499	329
390	699	469
393 (Req Interface)	1399	915
Panasonic		
KXP1080i-2	299	159
KXP1091i-2	329	185
KXP1592	699	389
KXP1595	749	419
KXP1524	949	519
Star		
NX1000	289	169
NX2400	499	339
NB2410	699	449
Toshiba		
P321SL	749	459
P341SL	999	629
P351SX	1499	929

BOARDS

	LIST	FAST
AST		
Hot Shot 286	645	339
Six Pak Plus 64K	210	119
Everex		
1200B Int Modem	149	73
2400B Int Modem	249	149
Genoa		
Super EGA Hi-Res+	399	175
Super VGA #5100	445	239
VGA Hi-Res #5200	645	359
Hercules		
Graphic Card +	299	169
Intel		
8087-2	250	149
80287-8	410	239
80287-10	480	269
Above Board 286	645	Call
Orchid		
VGA	399	229
Designar VGA	545	299
Tiny Turbo 286	445	269
Twin Turbo 12mhz	645	369
Paradise		
Basic EGA	199	Call
Autoswitch 480	349	169
VGA Plus	399	259
VGA Prolessional	599	369
5 Pack 0K	129	59
Practical Peripherals		
1200B Int Modem	99	65
2400B Int Modem	199	149
Prometheus		
Promodem 2400B	199	129
Promodem 2400G	249	159

The Complete PC		
Answering Machine	349	219
Fax	499	319
Hand Scanner	249	159
USRobotica		
1200 Baud Internal	149	69
1200 Baud Intsrnal	179	89
2400 Baud External	249	129
2400 Baud External	279	149
Video 7		
Fast Write VGA	549	335
Vega Deluxe	379	189
Vega VGA	499	259
V-RAM VGA	799	469

LAPTOPS

Mitaubiahi		
MP-286L Dual	3195	1879
MP-286L 20mb	4595	2449
NEC		
Multispeed EL II	2295	1449
Multispeed HD	3695	2249
Sharp		Call
Toshiba		
T1000	1249	749
T1200F	2099	1369
T1200FB Backlit	2399	1499
T1200H	3499	2199
T1200HB Backlit	3599	2399
T3200	5799	3695
T5100	7499	4595
Zenith		
SuperSport Dual	2399	1599
SuperSport 20mb	3599	2399
SuperSport 286	4999	Call

MONITORS

	LIST	FAST
Amdek		
1280	999	669
210A	129	89
310A *Limited Offer!*	230	75
Magnavox		Call
Mitaubishi		
1409 RGB	399	259
1410 EGA	599	399
Diamond Scan 1381	799	489
NEC		
Multisync II	899	575
Multisync GS	279	189
Multisync Plus	1399	869
Princeton		
Max15	389	Call
Utilrasync	849	479
Sony		
1302 Multiscan	995	659
1303 Multiscan	825	499
Zenith 1490	999	599

DISK DRIVES

	LIST	FAST
Miniscribs		
40MB AT #3650	499	319
Mitsubiahi		
40MB AT MR535 22ms	825	399
Seagate		
20MB XT Kit #225	599	267
30MB XT Kit #238	699	287
30MB AT #138	599	299
40MB AT #251	899	349
80MB AT #4096	1199	599
Toshiba		
360K Floppy	119	77
720K 3.5" Floppy	149	87
1.2MB 5.25" Floppy	149	87

Call On Non-Listed Items

SOFTWARE

Database

	LIST	FAST
Clipper	699	379
DataEase	600	379
dBase III+	699	359
dBXL Diamond	199	105
Foxbase Plus	395	185
Paradox	725	399
Quartz	795	449
RapidFila	295	179
Rbase for DOS	700	419
Reflex	150	84
Q & A	349	179

Desktop Publishing

Bylina	295	175
GEM Desktop Pub.	299	169
Pagamaker 3.0	795	Call
PFS:First Publisher	129	69
Publishar's Paintbrush	285	149
Ventura 2.0	895	459

Financial

Bedford Integr. Acct.	249	149
BPI		Call
Computar Associates		Call
DAC 3.0	99	59
DAC Payroll 3.0	99	59
Dollars & Sense	179	99
In-House Accountant	199	109
Managing Your Money	199	117
Peachtree Complete II	199	149

Graphics

	LIST	FAST
Boeing Graph	395	199
Deluxa Paint II	105	67
Draw Applause	495	269
Freelance Plus	495	Call
GEM Drew Plus	299	165
Generic CADD	99	49
Graph Plus	495	299
Harvard Graphics	495	Call
PrintMastar Plus	60	27

Integrated

First Choice	159	85
Works	149	89
Windows 286	99	59
Windows 386	195	117

Mica

Logitech C7 Serial Bus	119	65
Logitech HiRes Bus	150	83
Microsoft Serial/Bus	150	95
Microsoft W/ Windows	200	129
PC Mouse II Serial Bus	149	84

Power Protection

Curtis Ruby Plus	115	59
Datasheild 85	90	50
Datasheild 100	99	57
Isobar 4-6	80	42

Programming

	LIST	FAST
Macro Assembler	150	89
Norton Guides (Specify)	100	58
Turbo Basic	99	58
Turbo C 2.0 New!	149	87
Turbo Pascal 5.0 New!	149	87
Quick Basic	99	59
Quick C	99	59

Spreadsheets

Excel	495	Call
Lotus	495	Call
Lucid 3-D	149	79
Plan Perfect	395	189
Quattro	248	139
Worksheet Utilities	100	55

Utilities

CoreFast	149	87
Desklink	170	95
Desqview	130	73
Fastback Plus	189	87
Formtool	95	54
Laplink Plus	140	77
Norton Advanced	149	74
PC Tools Deluxe	80	36
Sidekick Plus	195	119
XTree	70	34

Word Processors

	LIST	FAST
Easy Extra	99	55
GEM First Word Plus	199	117
Grammatik III	89	49
Manuscript	495	Call
Multimata Adv. II	565	247
Professional Write	199	105
Rightwriter	95	49
Sprint	195	119
Q & A Write	199	119
Webster's Writer	60	47
Word	450	Call
Word Perfect	495	Call
Word Perfect Library	129	59
WordStar Prof. 5.0	495	219
XyWrite III Plus	445	299

Call On Non-Listed Items

TERMS: Most Orders Ship Within 48 hours. No Charge for Visa or MasterCard. Shipping Charge 3% (Min $4). Product warranties, offers & claims are handled by the manufacturer. All returns are subject to 15% restocking fee, call for RA number. No returns on used items. COD's add 5%, restrictions apply. Personal company checks delay shipping. Compatibility not guaranteed. Prices/availability subject to change. AZ orders add 6.7% tax. For your protection, we check for stolen credit cards.

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CIRCLE 352 ON READER SERVICE CARD

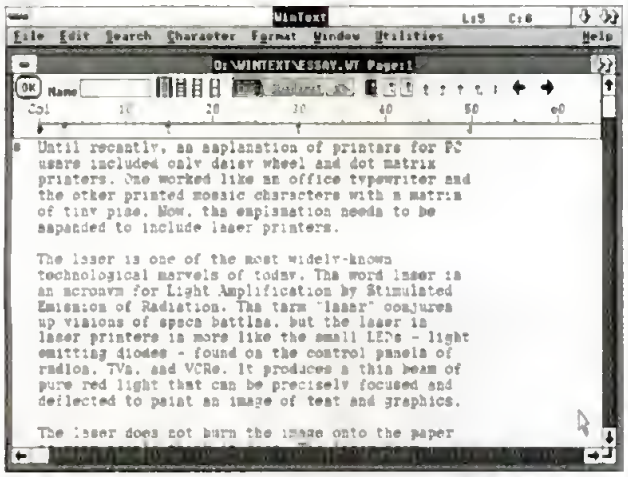
WinText Windows Word Processor: First, Full-Featured, and Flawed

PC HANDS ON

BY CRAIG STINSON

WinText's claim to fame is that it's the first word processor on the market (other than Microsoft's own rather primitive *Windows Write*) created specifically for *Microsoft Windows*. As such, it offers all the usual benefits of the *Windows* environment—and the usual drawbacks. It also supplies features that make it a much sharper writing/editing tool than *Microsoft Windows Write*.

If you're now a *Write* writer, inducements to adopt *WinText* might include its multilevel and reversible undo capability, hyphenation logic, paragraph sorting, box drawing, mail-merging, ability to index a document by comparing the document with a separate file of words, and option to save all files in the workspace automatically at timed intervals. There's also a "lexicon" feature that lets you streamline text entry by assigning strings to Shift-Ctrl-alphabet key combinations.



The WinText ruler lets you click on and drag simple objects to set margins, line spacing, indentation, justification, and tab stops.

The Undo command not only can be "undone" itself (a handy feature) but can also reverse more than your most recent editing action. Up to 1,990 characters can be stored in it.

Hyphenation may be automatic or manual. In manual mode, *WinText* proposes, and you confirm, alter, or reject its decisions.

The boxing capability is less straightforward than in some other programs, but once you get the hang of it, it does the job. Rather than letting you use the cursor keys, *WinText* requires you to set "vertical" tab stops, which you can connect with horizontal strokes by pressing various Ctrl-function-key combinations. The vertical tabs by themselves are useful for inserting separators between text columns, but the text must be organized by hand; *WinText* has no columnar capability.

Indexes generated by *WinText* are suitable as starting points only. Subordinate entries, see alsos, and consecutive page references all have to be done by hand.

The salient characteristic of *WinText* is that it runs under *Windows*. Because the program's style is visual and "object oriented," it creates a working atmosphere that's quite different from any text-based word processor. Character attributes, such as italics and superscripts, are displayed on-screen as they'll appear on paper. If your printer allows, you can produce documents in a variety of fonts and sizes. And tabs, margins, and indents can all be manipulated with the mouse; you just open a ruler, click on the object you want to set, and drag it to its new location.

The other advantages conferred by *Windows* apply here as well. Graphics images created via drawing programs or imported via scanners may be copied into a *WinText* document by way of the *Windows* clipboard. Such images can then be scaled and moved by means of *WinText* commands.

Numbers from *Microsoft Excel*, database reports from *Omnis Quartz*, even formatted documents from *Microsoft Windows Write* can all be ported into *WinText* with ease. *WinText* itself allows you to keep up to four document windows open at any time. (The windows may be separate files or different views of a common file.)

On the output side, *WinText* supports all devices supported by *Windows* itself—and will continue to do so as new versions of *Windows* or new *Windows* printer drivers appear.

Unfortunately, there's a serious performance price to pay for these advantages. Even on a 16-MHz Model 80 with VGA (the system used for this review), screen update in *WinText* is pokey. Jumping from top to bottom of a modest (11K) file takes a little over 2 seconds. If you use fonts in nondefault sizes, you'll experience vexing delays whenever *WinText* has to repaint the screen.

There are other irritations, too. For starters, a mouse is not optional; some actions (such as setting tab stops) simply don't have keyboard equivalents. And the keyboard shortcuts on *WinText*'s document-window control menus don't work.

The title bar on a *WinText* document window remains dark even when *WinText* is not the active application; it appears as though two programs have the input focus at the same time. And when all *WinText* documents have been closed, the usual behavior of the Alt key—to activate the menu bar or select a different application—is suppressed. That means, among other things, that you can't use Alt-Tab to get back to the MS-DOS Executive.

A more serious bug cripples the program's spelling checker. This utility, a separate *Windows* application supplied with the word processor, works fine while you're checking words. But when it writes its corrections back to the file, it corrupts the file so that a jump from the beginning of the document to the end locks up the computer. This happened with three different documents we tested.

On top of all this, *WinText*, at a suggested retail price of $350, is a tad pricey. A number of text-based systems offer more features and better performance at comparable prices.

If you have good reasons to do text work under *Windows*, *WinText* is an improvement over the current competition. But with full-featured *Windows* word processors in the works at Microsoft and other companies, your best bet is to hold out until you see what the competition will offer. PC

PC MAGAZINE FACT FILE

***WinText*, Version 1.0**
Palantir
12777 Jones Rd., #102
Houston, TX 77070
(713) 955-8880
List Price: $350
Requires: 512K RAM, mouse, *Microsoft Windows* (Version 2 or later, *Windows/286*, or *Windows/386*), DOS 2.0 or later.
In Short: The first full-fledged *Microsoft Windows* word processor offers several advantages, but it's slow on-screen, flawed in its use of *Windows*, and priced high. Not copy protected.

CIRCLE 432 ON READER SERVICE CARD

Kaypro, electronic innovator since 1952, introduces a better way of doing business – The Direct Line.™ Now you can purchase the most advanced micro computers factory direct from Kaypro – or from a Kaypro Dealer Associate near you – with the prices, features, quality and support you demand.

KAYPRO INTRODUCES THE DIRECT LINE™...



KAYPRO SERIES 386

With standard 20-MHz processing and zero wait states, this OS/2-compatible powerhouse has speed comparable to IBM's PS/2 Model 80, Compaq's 386/20, and Dell's 310. The KAYPRO 386 is the ideal system for complex data-base management, CAD/CAM, and desktop publishing. And as a network fileserver, you'll find none better.

Our most popular configuration, the 386-20 Model K is featured below. We also offer an extensive array of optional configurations including disk drives, monitors, video adapters, chassis sizes and clock speeds.

386-20 Model K
Standard Features:

- Intel 80386
- 20 MHz
- Upgradeable "slot technology"
- 1 MB of 32-bit RAM
- Expandable to 8 MB on board (and 16 MB using additional slot)
- Socket for 20 MHz co-processor
- 5.25" 1.2 MB diskette drive
- 70 MB 28ms hard disk drive
- Dual diskette and hard disk controller
- Monochrome monitor and adapter
- Enhanced 101-key keyboard
- 1 parallel, 1 serial port
- 217-watt power supply
- Real-time clock
- 9 expansion slots (6 available)
- AT height chassis
- Security lock
- 30-day money-back guarantee
- 12-month limited warranty...†



KAYPRO SERIES 286

Even at 16 MHz (we have faster models), the KAYPRO 286 is faster yet less expensive than most standard 386 systems. And it's OS/2-compatible. The KAYPRO 286 is a speedy workhorse that is ideal for database management, business, and most sophisticated applications. It incorporates fully our extensive experience in AT compatible architecture.

Our most popular configuration, the 286-16 Model K is featured below. We also offer an extensive array of optional configurations including disk drives, monitors, video adapters, chassis sizes and clock speeds.

286-16 Model K
Standard Features:

- 80286
- 16 MHz
- Upgradeable "slot technology"
- 1 MB RAM
- Base RAM expandable to 16 MB (8 MB on system board)
- 5.25" 1.2 MB diskette drive
- 40 MB 35ms hard disk drive
- Dual diskette and hard disk controller
- Enhanced 101-key keyboard
- Monochrome monitor
- EGA "Wonder" video and adapter
- 1 parallel, 1 serial port
- LIM 4.0 support for memory over 1 MB
- Real-time clock
- 9 expansion slots (5 available)
- Socket for 80287 co-processor
- MS-DOS and MS OS/2 compatible
- Security lock
- 30-day money-back guarantee
- 12 month limited warranty †



KAYPRO SERIES PC

Here's the full-featured, economical desktop PC with the future built in. Thanks to its "non-obsolete" design, the KAYPRO PC is a snap to update. Card-based system components – including the microprocessor – can be upgraded, tested, or exchanged in seconds...

Our most popular configuration, the PC Model K is featured below. We also offer an extensive array of optional configurations including disk drives, monitors, video adapters, chassis sizes and clock speeds.

PC Model K
Standard Features:

- NEC V-20 (8088-compatible) microprocessor running at 9.54/7.15 MHz selectable to 4.77
- Upgradeable "slot technology"
- 640 KB of RAM
- 5.25" (360K) diskette drive
- 30 MB hard disk drive
- Enhanced 101-key keyboard
- High performance hard disk drive interface
- Diskette controller integrated on processor board
- Monochrome monitor and adapter
- 1 serial and 1 parallel port
- Socket for 8 MHz 8087 co-processor
- 30-day money-back guarantee
- 12 month limited warranty †

Also from Kaypro...
THE KAYPRO MICRO I

The MICRO I from Kaypro is power and performance packed into the industry's smallest desktop system (12 x 12 x 2.5 inches).

Standard Features:

- 8088-compatible
- 16-bit processor
- 4.77/7.15/9.54 MHz clock speeds
- 512 KB RAM
- Expandable to 640 KB without additional boards
- Two 3.5" 720 KB micro-floppy disk drives
- CGA, MDA, Hercules-compatible monochrome graphics (720 x 350 resolution)
- 84-key keyboard
- Real-time clock
- 1 parallel, 1 serial port.
- 12 month limited warranty. †



More Made-in-the-USA Products from KAYPRO...

KAYPRO 2000+

The KAYPRO 2000+ offers professional grade power and performance. The KAYPRO 2000+ features one of the most readable laptop video displays available. The high-contrast EGA LCD screen utilizes a revolutionary cold cathode backlighting, giving it twice the contrast and readability – even in glaring natural or artificial light.

Standard Features

- NEC V20 (80C88-compatible 4.77/8.0 MHz)
- 768 KB of RAM
- Dual 3.5" floppy disk drives (720) KB each)
- Serial, parallel, 5.25" floppy drive, and monitor ports
- Non-glare, supertwist LCD (640 x 400) cold-cathode backlit
- 12-month limited warranty...†

Kaypro/Novell Networks

Kaypro is now your complete networking headquarters. With extensive experience in NetWare 2.11 (ArcNet, Ethernet, and other topologies), Kaypro Network sales, service, and installation experts stand ready to assist you with all your professional networking needs. Call for more details.

Peripherals

Kaypro offers and supports a full line of peripherals including printers, monitors, tape and disk storage devices, modems, as well as most popular application software packages. Call for more information and complete catalog.

We are so confident in our quality products that we provide a 30-day money-back guarantee, which provides that any system purchased from us can be returned within thirty days from the date it was shipped to you for a complete refund of your purchase price.

For more information and a complete catalog of all our Kaypro Products call

†Details on warranty coverage available directly from Kaypro or through Kaypro Dealer Associates.
*All price references reflect Kaypro Direct Sales only. Dealer Associates sales prices and product offerings may vary. Prices and specifications subject to change without notice. Please inquire for full and current details. Kaypro cannot be responsible for errors in typography or photographs.

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Visa & Mastercharge Accepted

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CIRCLE 132 ON READER SERVICE CARD

IBM Interleaf Mixes WYSIWYG Word Processing, Charting, and Illustrating

PC HANDS ON

BY EDWARD MENDELSON

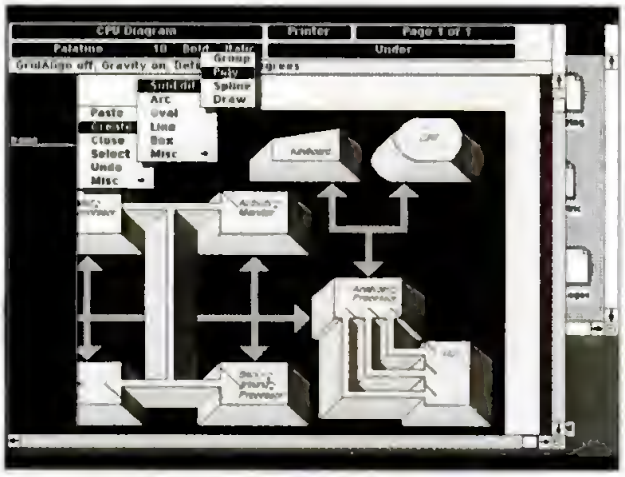
IBM Interleaf Publisher may be the most ambitious program ever written for a personal computer. It combines the functions of a graphics-based word processor, page-formatter, charting program, and illustration program into one package.

Unlike the so-called "integrated" programs that make you jump from one module to another when you want to switch from writing to graphics, *IBM Interleaf Publisher* makes all its features instantly available on the same screen and in the same document. You can first type the text that introduces a chart, next move down a line or two and create the chart itself, then create icons to illustrate the chart. Moving between the text and images is as simple as clicking the mouse. The package works well on a single computer but is also designed to be used in networks.

The bad news? *Interleaf* lists at $2,495, fills 20MB of your hard disk with 500 directories containing 1,500 files, and requires an 80386 processor, VGA or 8514/A video, and a PostScript printer. It also needs a *minimum* of 6MB RAM.

Interleaf doesn't look like anything else you'll find on a PC. Everything is graphics-based: documents, templates, and even links between documents appear as icons on a desktop. There are no *Microsoft Windows*–style menus.

Instead, a menu pops up at the cursor position when you press the right button on the mouse; the menu is different depending on the location of the cursor and what you are doing when you call for a menu. You call up submenus by moving the mouse across the menu until you reach the option you need and release the mouse button. At first this feels strange, but it soon makes *Windows* applications seem stumblingly awkward by comparison. *Interleaf*'s menus are smart enough to remember the last command and repeat it with a simple click.



IBM Interleaf Publisher *($2,495) enables you to produce complex graphics on the same screen that you use for writing and editing your text.*

Interleaf handles huge cross-referenced documents effortlessly and can even create both separate and combined indexes for multivolume books. You can change 100 pages of text from one- to three-column format in a second, and then jump from page 10 to page 90 in less than a second.

The package offers all standard word-processing functions, including a spelling checker and a hyphenation dictionary. You work in full WYSIWYG mode and enter proportional-spaced text in multiple columns, while the screen displays the finished page in full scale.

In networks, it may be best to give users who only write text a copy of *Interleaf PCEditor*, a $695 text-mode word processor that creates or edits *Interleaf* files but ignores graphics. Don't look for a wide range of import options. If you use 2-year-old versions of *WordStar*, *MultiMate*, or *Microsoft Word*, you can bring in formatted text. And you can also use documents from DEC word processors and any program that can create files in IBM's DCA format. You'll have to convert all *WordPerfect* files to DCA before importing.

Interleaf's charting function is designed for serious presentation of data rather than dazzling 3-D presentations. It includes dozens of format options and lets you control measurements down to one-millionth of an inch. You have limited import options: *Interleaf* won't read spreadsheet files but expects you to bring in data as a document and then paste it into a graph.

You can create elaborate images using graphics primitives or freehand drawing. *Interleaf* lets you resize, rotate, stretch, and duplicate any element in an image—including text. You can control the "gravity" between graphics elements and create isometric images from ordinary ones. With line art as with text, *Interleaf* imports in only a few formats: HP's graphics language, MacDraw's PICT, and CalComp's format for plotters. Line art can be edited down to the pixel level. You can import scanned images in TIFF format, but these can only be cropped or resized.

Interleaf won't do everything you want it to do, but it performs its myriad functions expertly and reliably.

It doesn't try to rival the design options in *PageMaker* or *Ventura Publisher*. You can't wrap text around graphics or adjust word- and letter-spacing, although you can manually kern headline type. But you won't buy *Interleaf* to put a beautiful finish on text and graphics created elsewhere. If you buy it, you should plan to use it as a complete, industrial-strength environment for creating and revising documents. It's the sort of program you use to write the technical reference manual for a space station—although it also includes a template for printing a business envelope.

Like the best CAD/CAM designs, *Interleaf Publisher* changes the balance of power among mainframes, workstations, and PCs. The unwieldy batch-mode formatting programs used on mainframes for creating large documents have begun to go the way of the dinosaur.

PC MAGAZINE FACT FILE

IBM Interleaf Publisher
IBM Corp
Available through IBM dealers.
List Price: $2,495
Requires: 6MB RAM, 80386-based computer, 25 free MB on a hard disk, VGA or 8514/A adapter, DOS 3.3 or later.
In Short: A massive and powerful program combining graphics-based word-processing, page formatting, charting, and graphics. Designed for large workgroups as well as individual use. Not copy protected.

CIRCLE 446 ON READER SERVICE CARD

***Interleaf PCEditor,* Version 3.0**
Interleaf Inc
Ten Canal Park
Cambridge, MA 02141
(617) 577-9800
List Price: $695
Requires: 512K RAM, DOS 3.1 or later
In Short: A text-editor that creates files usable by *IBM Interleaf Publisher*. Not copy protected.

CIRCLE 447 ON READER SERVICE CARD

No matter which of these modes you use,

40-column CGA Text
40-column EGA Text
40-column VGA Text
80-column CGA Text
80-column EGA Text
80-column VGA Text
Lo-res CGA Graphics
Hi-res CGA Graphics
MDA Monochrome Text
80-column VGA Monochrome Text
Lo-res MCGA Graphics
Lo-res VGA Graphics
Med-res VGA Graphics
EGA Monochrome Graphics
Hi-res EGA Graphics
Hi-res MCGA Graphics
Hi-res VGA Graphics

we have the VGA display for it.



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With a VGA display system, you'll get the most out of your present software and prepare yourself for graphics environments like Windows 386, OS/2,™ and Presentation Manager.™ Resolutions include 720 x 400 for text, and 640 x 480 in 256 colors for graphics.

Both displays have a 14" CRT, versus the 12" industry standard. And both come with a built-in tilt/swivel base and are backed by a 2-year limited warranty—twice as long as most other brands.

At $229 for the 7BM749 paper-white monochrome and $649 for the 9CM082 color display, Magnavox makes VGA displays affordable.

MAGNAVOX
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RELIANT

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Two Year Data Loss Recovery Contract.

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Sysgen's rugged design and excellent price/performance will give you peace of mind—and to give you maximum flexibility, all Reliant backups are available in both external and internal versions.

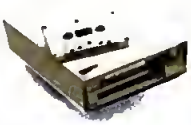
But RELIABILITY is what backup—and Sysgen—are ultimately all about.

Series 300: Streaming backup on industry standard ¼" cartridge.



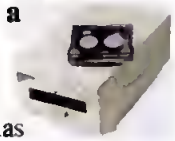
Systems are available at 60 and 125 MB capacity levels. Menu-driven software includes Reliant's exclusive *Autoverify* feature. Comprehensive backup features for Novell,® IBM,® and 3COM® make Series 300 ideal for network use.

Series 200: Cost-effective streaming backup on digital cassette.



Series 200 offers 60 MB capacity in a small 6" x 8" footprint. Data is stored on a compact cassette—you'll never struggle with a pile of floppy disks again. You can pre-set your backup times for automatic operation, while fast 5 MB per minute performance assures your data will be secure—at your convenience.

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INCORPORATED
556 Gibraltar Drive, Milpitas, CA 95035

CIRCLE 173 ON READER SERVICE CARD

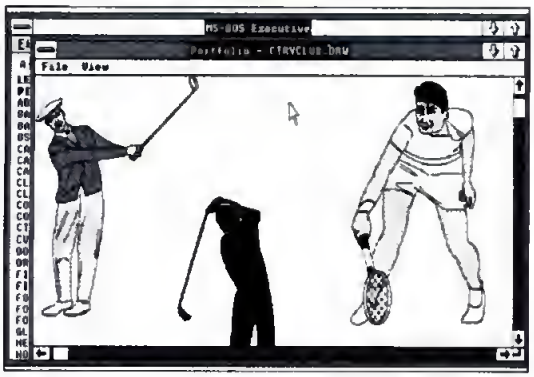
*All claims subject to the terms and conditions set forth in the Sysgen Data Loss Recovery Contract. Sysgen is a trademark of Sysgen, Inc. XT, AT, PS/2 are trademarks of IBM Corp. IBM, Novell and 3COM are registered trademarks.

PC UPDATE

by Paula Seefeldt

Micrografx Extends ClipArt Collection

Micrografx has added four new *ClipArt* libraries: *Anotomy, Sports and Recreation, Business Forms,* and *Heodline Typefaces IV*. With these additions, Micrografx now provides over 12,000 resolution-independent images. *Clip-Art* libraries are individually priced at $79.95. A copy of Micrografx Portfolio will also be bundled free with each library. *ClipArt Collections*, a series of five libraries, is available for $249.95. Anatomy and U.S. Maps are considered "Special Edition" ClipArt, and retail for $149.95 each. Micrografx, Richardson, Tex.; (214) 234-1769.



Sports symbols are now included in Micrografx's *set of* ClipArt *libraries.*

Adobe Extends Type Library and Publishing Pack

Adobe has included a third package in its *Adobe Type Library Publishing Pack* series. *Publishing Pack 3: Presentations* enhances business presentations such as slide shows, flip charts, and proposals using a specific collection of typefaces. *Publishing Pack 3: Presentations* is available for $475 . . . Six new typeface packages have been incorporated into the *Adobe Type Library*, expanding it to a total of over 250 individual typefaces. The new packages are *Italia, Belwe, Eras, Goudy 2, Janson Text,* and *Caslon 3 ond Caslon 540*. Prices for the packages range from $95 to $375. Adobe Systems Inc., Mountain View, Calif.; (415) 961-4400.

Support for DOS 4.0

The Norton Utilities and *The Norton Utilities Advanced Edition* are now available in a DOS 4.0–compatible version. *The Norton Utilities* upgrade is $25, with new packages retailing for $100. The *Advanced Edition* upgrade is $50 and new packages are $150. Peter Norton Computing, Santa Monica, Calif.; (213) 319-2000 . . . IGC has also added DOS 4.0 support to its latest release, the ***Professional Multitasker,*** Version 1.2. Updates are available for $50 and registered users will receive a coupon for a 50 percent discount. New packages retail for $245. IGC, Santa Clara, Calif.; (408) 986-8373.

Optasm Adds On-line Help

Optasm, SLR Systems' MS-DOS assembler for 8086–80286 processors, now provides comprehensive on-line help. Version 1.5 also includes full support for Microsoft's CodeView debugger. Upgrades are $29.95 for registered users. New packages are $125. In addition, a demo disk is available for $10 or can be downloaded from SLR Systems' BBS at no charge. SLR Systems, Butler, Pa.; (412) 282-0864.

Bedford Provides Comfort Guarantee

Bedford Software has devised a Comfort Guarantee to ensure that customers receive the most-current software releases. All purchasers of Bedford Software will receive a questionnaire, which should be completed and returned to the company. Bedford Software will then determine whether the purchase is the most recent update. If the software is not current, the customer will be sent a new version, free of charge. Bedford Software, Redmond, Wash.; (604) 294-2394.

Cost-Cutting Updates

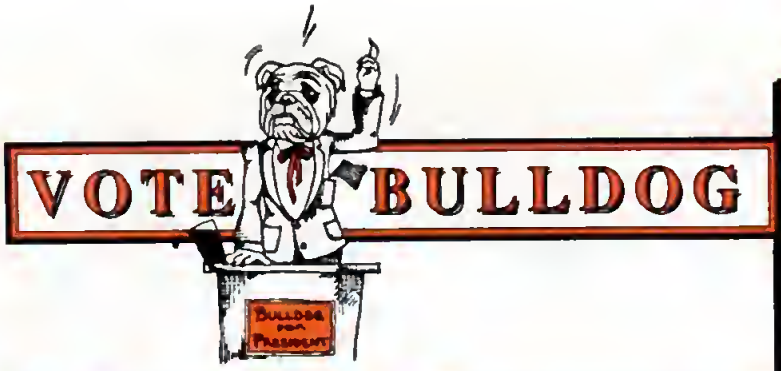
Quadram is shipping Version 1.14 of its operating software to all registered **JT Fax** owners, free of charge. Version 1.14 offers several new utilities, including a cut feature that allows graphics images to be cut and saved in separate files. Quadram, Norcross, Ga.; (404) 923-6666 . . . STB Systems has decreased the cost of its entire line of video, memory, I/O, and multifunction boards by 9 to 26 percent. STB Systems, Richardson, Tex.; (214) 234-8750.

PC-Write 3.0 Creates Larger Files

PC-Write, the shareware word processor from Quicksoft, has added more than 500 new features. Version 3.0 extends the 60K file limit, provides new formatting features, and uses shortcut keys. In addition, Quicksoft offers "PC-Write and Friends," a catalog listing of compatible programs. *PC-Write* 3.0 is sold as shareware for a registration fee of $89. A volume discount license is available to groups and educational institutions. Quicksoft Inc., Seattle, Wash.; (206) 282-0452.



Column formation is one of PC-Write's *new formatting functions.*



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Model 80 - 40.....**4375**
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1 floppy, 640K, AT style keyboard, monographics card, mono monitor.....**$799**
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292 240 CPS, 100 NLQ	439
293 Plus 240 CPS, 100 NLQ	575
393 450 CPS, 120 LQ	925

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Toshiba 3700	1995

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Proprinter XL24	725

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CMS 5¼" ext. 1.2 mb for PS/2	259
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Pacific Rim 5¼ ext. 1.2 for PS2	219
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Toshiba 5¼" 1.2 mb int.	99
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Practical Peripherals half card 2400 w/Procomm	159
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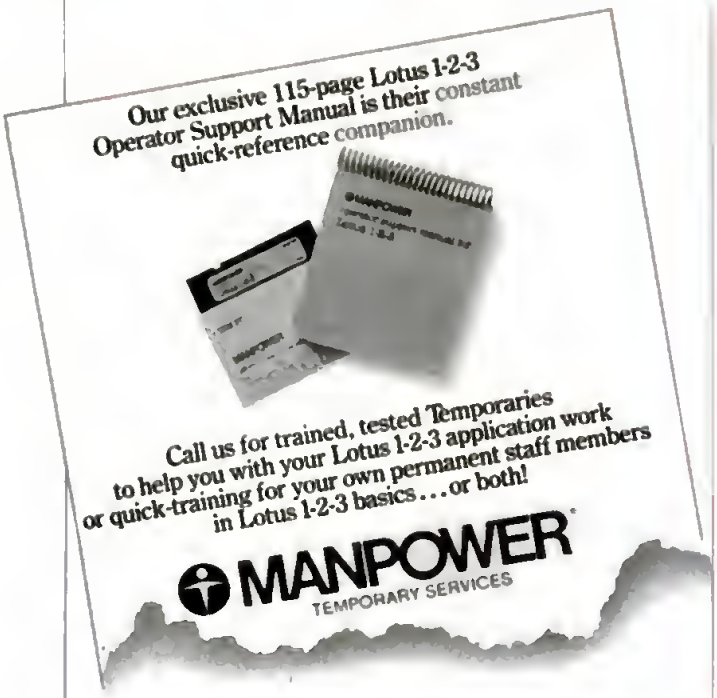
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CIRCLE 481 ON READER SERVICE CARD

COMMUNIQUÉS

edited by Bill Howard



What to do when the floppy disk is notched in the wrong place. See page 116. (Manpower Temporary Services advertisement)

Order Now and We'll Include–Free–DAK's Exclusive Hyperbole Checker

From an advertisement for a DAK Industries 10-MHz AT-compatible system:

"Enter EGA. It's great. Now you can have 16 colors on sereen at once. Now you can choose from a pallet [sic] of 64 colors. Most people don't use EGA yet because it's normally extremely expensive . . . .

"It has a 5¼" 1.2 Megabyte Floppy Drive. Forget the standard 360K floppy drives . . . .And of course, you can still use and interchange 360K floppies with less sophisticated people than yourself . . . .

"It simply outran, outmaneuvered and overpowered every other [AT-compatible] computer I tested . . . .

"To order Packard Bell's incomparable 10MHz AT Compatible Computer Complete with 40 Megabyte Hard Drive, 1.2 Megabyte 5¼" Floppy Drive, EGA Monitor with Tilt Swivel Base, DOS and GW Basic plus all DAK's Bonuses described below [mouse, graph/chart, paint and banner-making programs, spell checker/thesaurus—"over $1438 retail value"], don't send the suggested $6637 retail price. Don't even send my approximate 'best guess' discount street price of $3852 . . . . Send DAK's incredible breakthrough price of just $1999 . . . ."



Given the prices, mail-order dealer Applied Progressive Electronics Inc sells appropriately named diskettes.

Amazing Facts

"The Northwest is one of five leading technology centers in the world . . . .The world's three premier operating systems for nonframe [sic] computers—OS/2, MSDOS and UNIX—are products of Microsoft in Redmond, Washington."

—Pacific Northwest *magazine, February 1988*

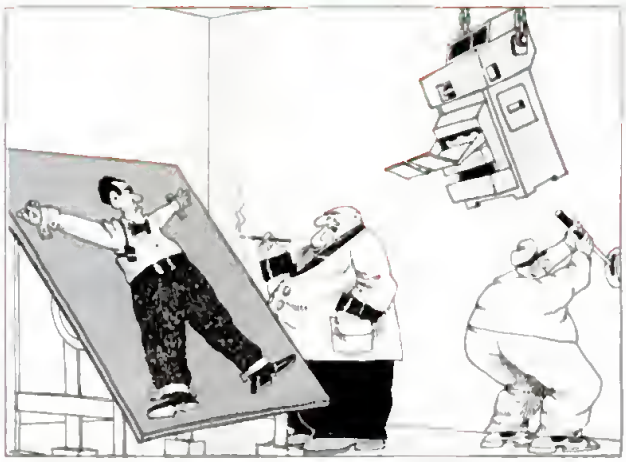
Powerful Electrons

"On a raster scan display monitor, a beam of electrons sweeps across the inside face of the screen from side to side, top to bottom. This scanning beam eliminates the pixels."

—Computer Products, *May 1988*



Sure we're sure they're erorr-free. Why, we sent this very ad copy to the printer on one of our disks. (Ad for Americal Group, Sherman Oaks, Calif.)

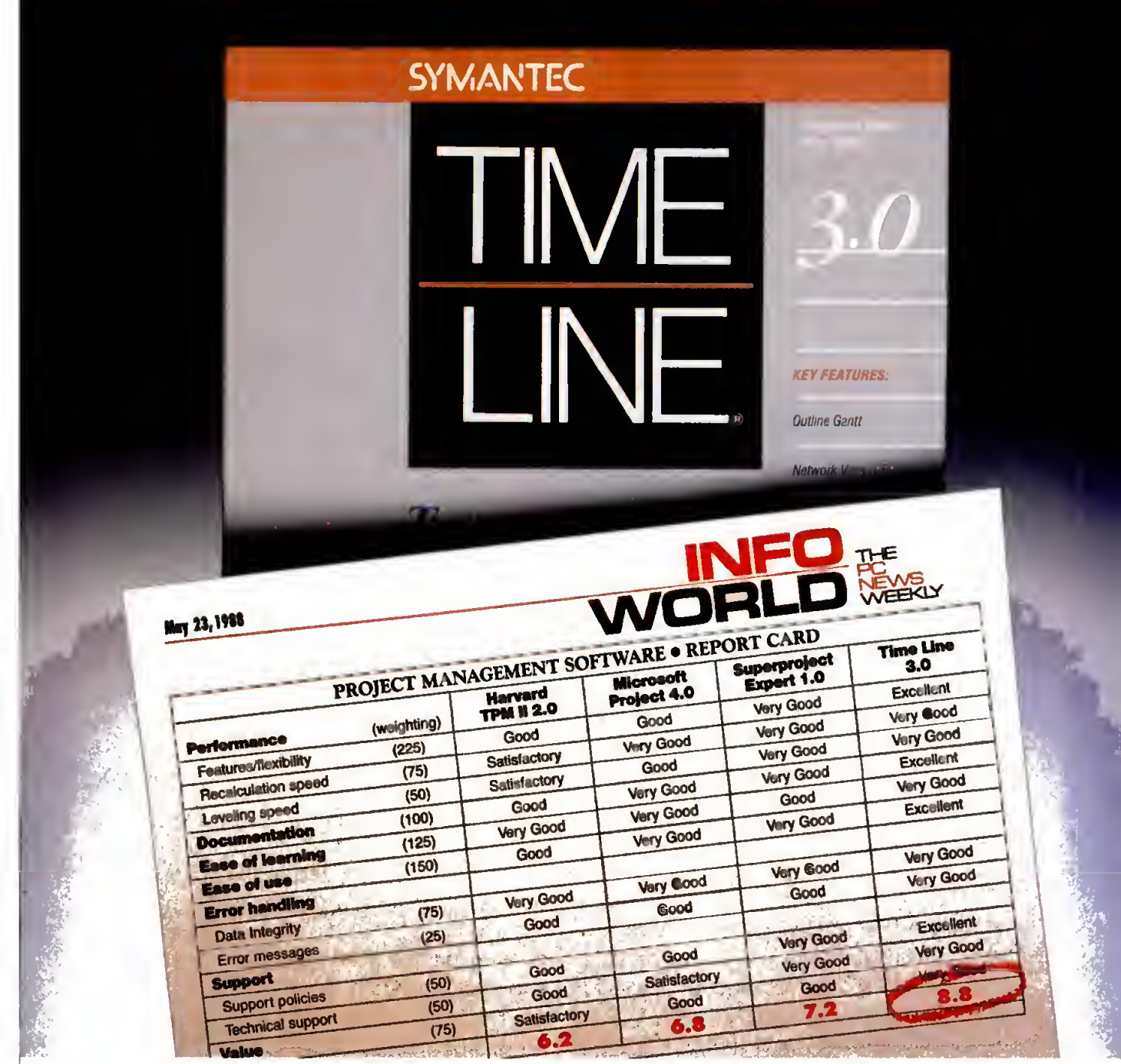


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Winners for this issue. Dennis Levin (Manpower), Bruce Dennis (erorr free), Mark Foster (platinum disks), Paul Braren (DAK), R Wells (Northwest), James Harris (pixel eliminatar).

Illustration, Richard Tennant



May 23, 1988

INFO WORLD THE PC NEWS WEEKLY

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Ease of learning	(125)	Good	Very Good	Very Good	
Ease of use	(150)				Very Good
Error handling		Very Good	Very Good	Very Good	Very Good
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Error messages	(25)				Excellent
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CIRCLE 365 ON READER SERVICE CARD

■ BILL MACHRONE

PC MAGAZINE VS. THE READERS



PC Magazine's readers are opinionated. Pro or con, the bagfuls of mail we get rarely surprise us. But it was a simple cover blurb on a recent issue that really set things off.

It started out quite innocently, as these things usually do. We were looking for a peppy cover blurb to convey our excitement over the delivery of a machine using Intel's long-awaited 80386SX chip. The machine, of course, was the Compaq Deskpro 386S. The cover line was "Why You'll Never Buy Another 286."

Hyperbole aside, it was a pretty good blurb, and it certainly performed its primary task of focusing attention on Intel's positioning of the 386SX as the midrange chip of choice. We value the things that the 386 can do pretty highly around here. We got on the bandwagon early and have stayed there ever since. What we didn't count on was the ire and deep-seated antipathy of those who don't agree with us.

The first sign of trouble came when Julie McHenry, one of my favorite public-relations people, called and suggested that I might want to talk with some of the folks from Advanced Micro Devices, who begged to differ (to put it mildly) with our blurb. AMD, you'll recall, has a license from Intel to produce 80286 chips and had thought it was licensed to produce the 80386 as well. Intel, however, decided that *it* wanted to be the sole source of 386 chips. The matter will now be resolved by the courts.

AMD's sensitivity to 286-vs.-386 issues is understandable. Even so, I was surprised at how bent out of shape AMD's representatives were about the 386SX. They argued that a 20-MHz 286 was faster than the 16-MHz 386SX. Well, sure, I said. They pointed out that even at 16 MHz, the 286 was still faster than the 386. That's actually true, as well.

When you compare the 16-bit instructions of the two chips, 74 of them are faster on the 286, 66 are the same, and 50 are faster on the 386. Since the software you're running is 16-bit (DOS, OS/2, and virtually all applications), the 286 is faster, Q.E.D. That begs the question, What about the 32-bit environments, such as Unix, *Windows/386*, and the various 32-bit extensions to DOS? But when you don't have a 32-bit chip to sell, you don't talk about 32-bit environments.

AMD's Glenn Birchers and Ed Huber also took issue with our comment on the price differential between 286-based systems and 386SX-based systems. They feel that the increment is more on the order of $1,000, rather than the $500 or so we stated in the article. Only time will tell. The conversation ended amicably enough, with both sides commenting that what the 286 really needs is memory management.



VOX POPULI The next onslaught came from readers. People wrote to tell us we were a bunch of unreconstructed performance junkies and other things that we already knew. They also said that the 386 instructions set is unimportant and that the real issue is cost. Many said that you don't need anything more than a fast 286 to run DOS applications.

Several of our readers went so far as to tell us that the die size (the actual piece of silicon that makes up the chip) would always force the 386SX to cost more than the 286. One reader, perhaps with inside connections at Intel, said that the 386SX would never be available in great quantity or at reasonable prices because it is built on the same fabrication line as the 80386. The logic, according to him, is that Intel can make more money on full 32-bit 386 chips and will always bias its production toward them. Ed Huber at AMD made the same point, emphasizing that the 286 will always be cheaper and easier to build in quantity.

Their conclusions were based on the assumption that Intel will price the 386SX in strict accordance with its manufacturing cost. Pricing, however, is a function of marketing strategies, not manufacturing techniques. The real question is, To what extent is Intel willing to cannibalize its own midrange 286 business in order to spread the gospel of the 386? To what extent will it sacrifice profits in order to compete with 80286 manufacturers such as AMD and Harris? The 386SX can be priced anywhere this side of predatory to accomplish those goals.

Illustration: Mark Matcho

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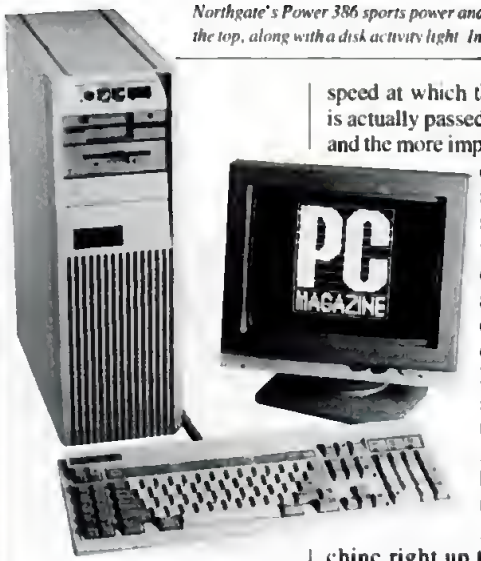
BY BILL O'BRIEN

Field-leading 386 performance just got cheaper. Northgate Computer Systems' Power 386 rivals the power of the Compaq Deskpro 386/20 at a fraction of the cost.

The Power 386 is an upright, 20-MHz floor model with a base price of $4,295—including a high-performance 65MB hard disk.

A 64K static RAM memory cache deserves much of the credit for the Power 386's performance. Like the Deskpro 386/20, the Power 386 maintains a high-speed, 32-bit path to memory, separate from the I/O bus.

Whereas the 386/20 makes use of Intel's sophisticated cache controller chip, however, the Power 386 falls back on a direct-map static RAM system composed of discrete logic components. Compaq's solution no doubt earns it memory access performance gains in some cases, but the Power 386 won't be far behind.



Northgate's Power 386 sports power and reset switches at the top, along with a disk activity light. Inside are eight slots.

The hard disk drive does not have an overly spectacular track-to-track access time—28 milliseconds—but that is a mechanical measurement of disk capability. Data throughput, the speed at which the information is actually passed across the bus and the more important measure of performance, rates as spectacular when hard disk caching is enabled. But even without caching, the large- and small-record times for the PC Labs benchmark tests rank the Power 386 machine right up there with the Compaq Deskpro 386/20.

The standard configuration includes a 14-inch monochrome monitor, one 5¼-inch 1.2MB floppy disk drive, and one 3½-inch 1.44MB floppy drive. That leaves you with one empty half-height bay.

Whether you purchase this 386-based machine for its price tag or for its performance, the chances are that you won't be disappointed. Watch *Microsoft Windows* load quickly for a change, or observe a pull-down menu snap up like a runaway window shade, and you will finally get an honest feel of what speed is all about. PC

PC MAGAZINE FACT FILE

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Northgate Computer Systems
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List Price: With 1MB DRAM, 64K SRAM cache, one 5¼-inch 1.2MB floppy disk drive, one 3½-inch 1.44MB floppy disk drive, 65MB hard disk, monochrome monitor, $4,295.
In Short: The Power 386 delivers top performance and intelligent design at an excellent price.

***NOTE: Reprinted in full without editing, to give you the complete picture.**

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OTHER EXPERTS AGREE...

Steve Gibson, InfoWorld, 3/21/88
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Computer Shopper, 6/88
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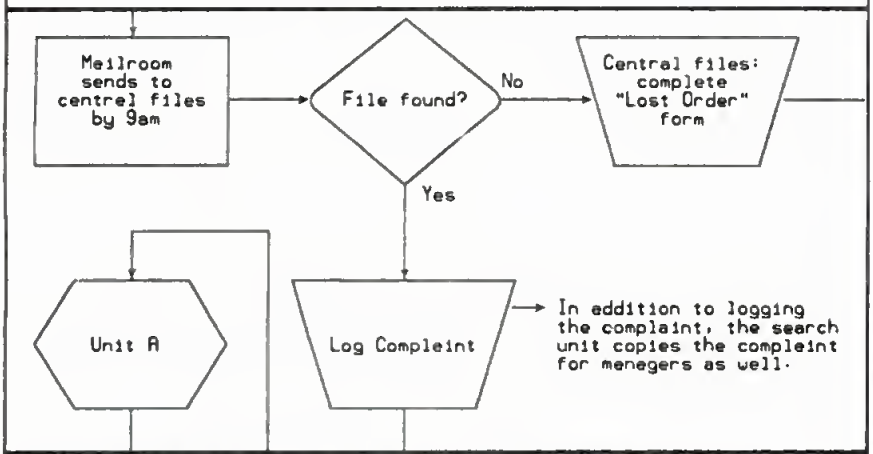
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CIRCLE 201 ON READER SERVICE CARD

■ BILL MACHRONE

286 DEAD END? One of the issues we raised with AMD was whether there is a future for the 286 beyond merely going faster. Specifically, we were asking about memory management. One of the joys of the 386 is its memory-management capabilities, which are usable even when it's just running DOS. Programs such as Qualitas's *386-to-the-Max* and Quarterdeck's *QEMM-386* let you exceed 640K, emulate expanded memory, hide TSRs and network monitor programs in non-DOS memory, and more. Would a 286 with a companion memory-management chip be a cost and performance challenger for the 386? AMD wasn't saying.

Meanwhile, further disproving our infamous blurb, some commercial products already address the 286 memory management problem. RYBS Electronics' HiCard adds memory specifically designed for getting TSRs and network programs out of DOS's 640K space. With All Computers' All Chargecard, you remove the 286, plug in the Chargecard, then plug the 286 back in. Its memory-management coprocessor remaps the system's RAM. In some cases, the DOS workspace can approach a full megabyte. *DESQview* makes especially good use of the Chargecard. Together, the two can do things you would have thought you needed a 386 for.

While memory management may be a fine plan for the future, speed is still today's biggest issue. We've tested the current crop of 16- and 20-MHz 286 machines and found them delightful, if just a teensy bit premature. As I write this, rumors abound that with 20-MHz parts in such short supply, a major manufacturer has been shipping its 20-MHz machines with 16-MHz chips. The review machines tested by the magazines, of course, all had 20-MHz chips. The customers are getting something different, at least until the shortage goes away.

When things like this happen, we get letters and phone calls that try to hang some of the blame on us. If we didn't create so much demand for these hyperthyroid machines, the story goes, manufacturers wouldn't be tempted to cut corners or juice up the review machines. Hey, if there weren't such a deep interest in these machines, we wouldn't bother to write about them.

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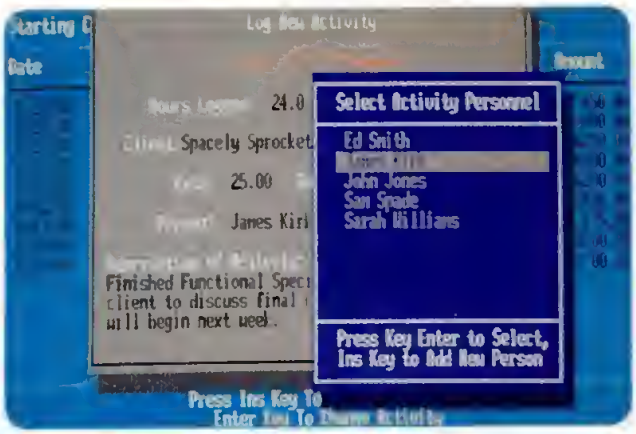
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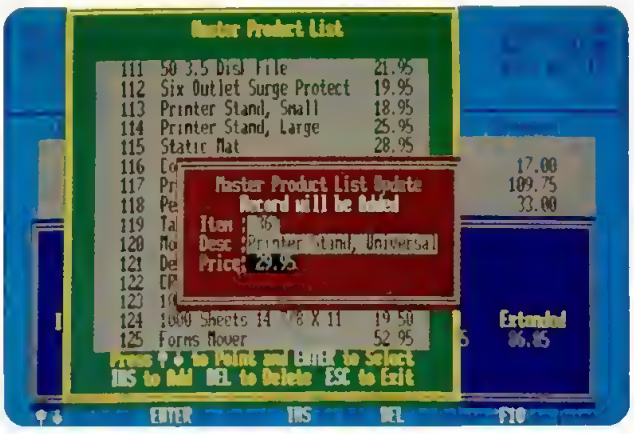
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CIRCLE 134 ON REAOER SERVICE CARO

■ JOHN C. DVORAK



VIRUS WARS AHEAD

The virus of the future is a selective predator, targeting only computers using software sold by specific vendors. And it may be planted by software companies out to wreck competitors.

I previously predicted that by this time next year the virus scene will have faded and people will reflect on it as one of the many fads in the microcomputer business. A fad that came and went. Now I'm convinced otherwise.

It was Robert T. McQuaid of Canada's McQuaid software who described the virus of the future. It has since become obvious to me that computer viruses are here to stay.

The opportunity for shenanigans is just too bountiful for viruses to go away. McQuaid foresees the day when a disgruntled coder will put a virus into the public domain that does nothing to any computer except those that are running software sold by certain vendors.

In other words, it might go out and look for an Ashton-Tate product. It goes from disk to disk, system to system, looking. "Slowly I turned! Disk to disk! System to system!" The people without the Ashton-Tate software never know it's there and unwittingly pass it along. They're carriers. Suddenly the virus hits a system with Ashton-Tate software and creates havoc. The disgruntled employee feels a lot better somehow.

KILLING THE COMPETITION At first I figured that this whole scene would ruin the market for public-domain libraries as contaminated files appear on more and more disks. In the San Francisco Bay area, Will Hearst, the publisher of *The San Francisco Examiner*, found his Mac II contaminated by the "scores" virus, which prevented him from executing the more advanced functions of a program called *Mathmatica*. A local radio personality, Alex Bennett, had to take his Amiga in for service because of a virus that nearly ruined the thing. These are local horror stories from just a couple of months ago!

As I considered these invasions, I realized it won't be only the public-domain libraries that are adversely affected. Let's face it: the viruses we've seen so far are merely amateurish junk code. But what's to prevent a vendor of a legitimate software package from vending something with a superior virus that seeks not to destroy a competitor's product but to make it buggy? It just moves a couple of key bytes—that's all. The offending company, if caught, can say it was a disgruntled employee who planted the nasty code. "Gee, we didn't know. It's terrible. We'll correct the problem."

How will we ever know? It might indeed be a disgruntled employee planting a virus to make the company look bad. Imagine some Microsoft code that went out looking for programs compiled by non-Microsoft compilers. Borland and others insist on inserting a message in the compiled code to let everyone know what product did the compilation. So the virus looks for the Borland name and then swaps a few bits around. The virus is discovered and a scandal ensues. Who to blame? What if someone working for Borland did it? An industrial spy somehow hired at Microsoft by accident? Can you imagine the kinds of intrigue we may have in the next few years? Lawyers: on your mark, get set . . . .



Illustration: Mark Matcho

BIG BROTHER WILL BE WATCHING I don't believe for a moment that any of these firms is incapable of or unwilling to pull some dirty tricks. Proprietary file schemes, mysterious junk code, and code scrambling are already rampant. This isn't done because our software firms all trust each other, is it? The next logical step in the marketing of software is to keep people from using the competitor's product at all costs. Viruses are likely to be discussed as a genuine strategy in the years ahead when the going gets tough.

Already we see dubious incompatibilities such as the "Incorrect DOS Version" message you get when you try to use the 3.3 format program with DOS 3.1. We may soon discover that the software is watching us. Making sure we do things the way some Big Brother out there wants them done. If we disobey, then a virus is released and—gotcha!

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■ JOHN C. DVORAK

INSIDE TRACK

The problem with programming; a companion for Word; an even cheaper modem; copy-proof paper isn't.

Before I **rant** about programmers, let me backtrack. A couple of months ago I saw Cab Calloway (now 81 years old) perform his old Cotton Club act at San Francisco's Fairmont Hotel. Calloway's songwriting career peaked in the mid-1930s, but he still performs and sounds pretty much the way he did 50 years ago. A lot of people would have **quit** while they were ahead. As those of you who have followed my writings know, I'm preoccupied with the creative process and its idiosyncrasies. Perhaps I'm just curious as to when I'll be unable to continue my **torrid** pace of column writing, or perhaps I'm just curious because that's the way I am. Whatever the case, guys like Calloway fascinate me, even when they're rightfully coasting at 81. I guess show business is a lot of fun.

Few songwriters can do much more than coast once they've written the songs that were in them. One wonders how much more **Mozart** would have really done had he lived to the age of 80. One wonders how much code today's hotshot programmer would do at the age of 80. Most of the programmers I know **burn out** at 30 (if not before) and spend useless years talking about how they want to supervise other programmers. Fact is, most good coders seem to quit *sooner* than they should.

This brings me to a memo I received from a reader. It was about the original designer of *Microsoft Word*, Richard Brodie. Brodie wrote *Word* 1.0 at the age of 21, when he was a student at Harvard. For this he got some stock, made some money when Microsoft went public, turned the code over to the company, and then **retired.** He now spends his time umpiring high school baseball games. Why should you code when you can get some *real* abuse as an ump?

So my question is: Is quality software coding such a **numbing experience** that only an elite few really enjoy doing it?

One thing is certain: the few fellows who love to code for the **thrill** of it are all **encamped** in the world of the Macintosh. As I look at this phenomenon, it's becoming increasingly apparent that the environment of the IBM PC/AT/PS/clone is **depressing** to the creative types, who'd rather take the money and run than continue to code—no matter how talented they are. I'm dead serious when I suggest that this is **a grave national problem** that should be investigated by the government if necessary. I'm not kidding. Think about all of the ramifications of the phenomenon before you kick back and laugh this off. End of sermonette #876.

■ One thing is certain: the fellows who love to code for the thrill of it are all encamped in the world of the Macintosh.

Genuinely Interesting Software Dept.: All this talk about *Word* reminds me of a **delightful** little utility disk that, among other things, replaces the **mediocre** *Word* help file with something usable. Also included are 300 interesting macros, a slug of usable tools, and a driver that lets *Word* accept *WordStar* commands! **The *Word Companion Disk*** is available for $19.95 from Peter Rinearson. Call toll-free—(800) 345-9111, ext. 36—to order a copy.

No Excuses Dept.: Just when I thought I had seen the **cheapest** modem available, along comes the 2,400-bit-per-second internal modem from GCH Systems, priced at $130 retail. There is no excuse not to have a modem on your machine anymore. They throw in a copy of *Procomm* too. For you **ultratightwads,** GCH makes a 1,200-bps internal modem for the PC that retails for an **outrageous $70!** I've been using the 2,400-bps modem for a month, with nothing to complain about except the aesthetics of the printed-circuit-board layout: ugly. The company is located at 845 W. Maude Ave., Sunnyvale, CA 94086; phone (408) 733-2131. It's a steal.

The Dvorak Keyboard Is Alive Dept.: Some things never go away, as I discovered when I received a letter from Randy Cassingham, a longtime Dvorak keyboard nutball. He pushes the keyboard with his $12-a-year newsletter and a **nifty** $20 program called *PCKey*, which can remap a PC keyboard as you desire. Its main job is to create a Dvorak keyboard. You have to move the key caps around yourself. Write him at Dvorak Developments, Box 1895, Uplands, CA 91785.

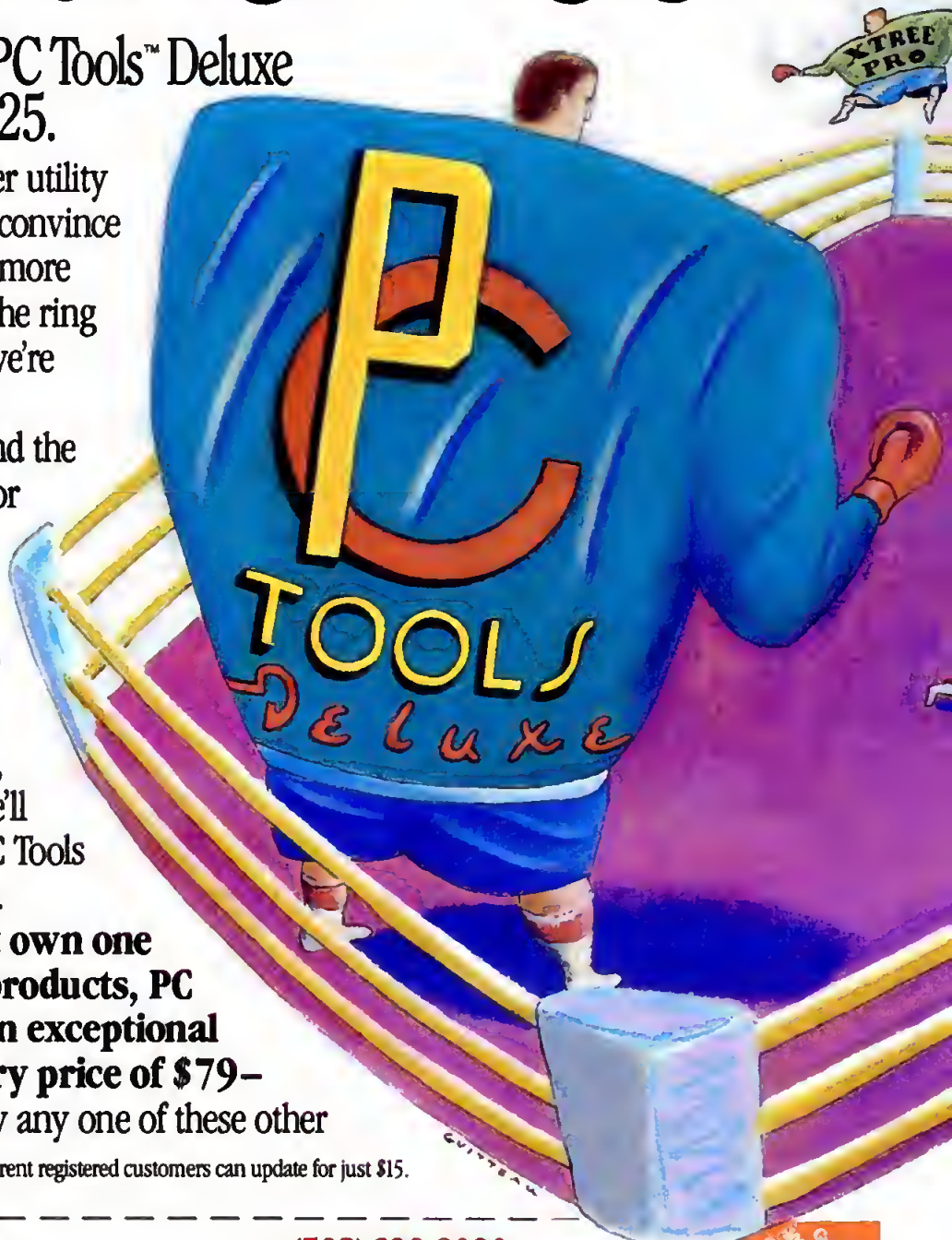
Trick of the Month. When visiting the Lucasfilm game division recently (to be shown *Maniac Mansion* and a few other new games), I was given a piece of "copy-proof" paper made by a Canadian firm. It's a **weird** red color. Lucasfilm uses it in the games to list passwords as a method of **minimizing bootleg** copies of the game. You can't play the game without the list. "It can't be copied!" I was told. I laughed. Within a few minutes after returning to my office, I was able to copy it by using an **inexpensive Chinon scanner** to scan it into *PC Paintbrush*, where it was turned into black-and-white hard copy—intact! I think I won a bet. Scanners are amazing.

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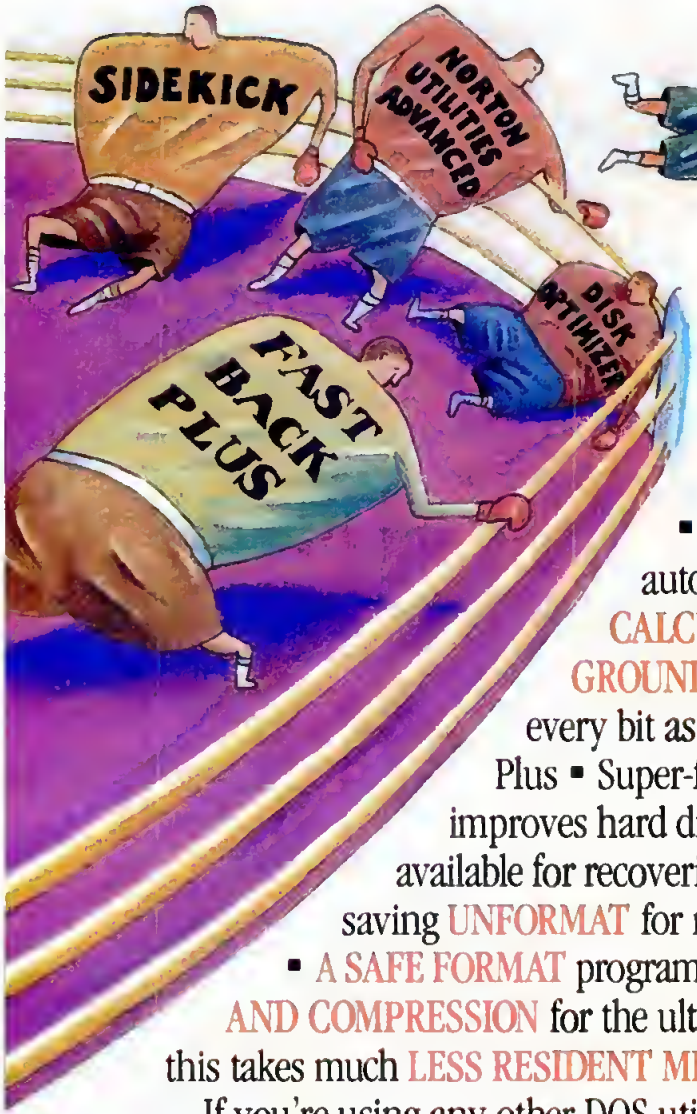
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■ JIM SEYMOUR

PS/2 CLONES: TIME TO "HEDGE AND STRADDLE"?



To clone or not to clone? That is the question facing would-be PS/2 clone vendors who want to get in on the market without destroying their cash cows—286 and 386 compatibles.

We've seen an enormous amount of back-and-forth movement on the likely economic viability and market impact of PS/2 clones. In The Beginning—which means April 2, 1987, the day IBM rolled out the PS/2s and the Micro Channel architecture (MCA) bus design—the sages forecast an early flood of PS/2 clones.

It wouldn't take long, we were assured, for smart clone shops to turn out true PS/2-MCA compatibles. Poor IBM: lapped again.

But then, as the complexities of the MCA bus design became apparent and the perfervid interest in the PS/2s that accompanied their introduction quickly cooled, the pendulum swung again. Since buyers weren't all that hot on PS/2s, we were told, PS/2 clones wouldn't be such a big deal, and we probably wouldn't see them for a while.

Then 4 months ago, Tandy and Dell announced their PS/2 clones—with Tandy promising real live machines in their stores before the end of the summer—and we were back to the idea that PS/2 clones would be a Big Deal.

Now we've swung back again in what has become a drunken sailor's walk of a market. I just saw a wonderful quote in one of the leading PC trade papers: a Dell executive was quoted as saying the strategy there now is to "hedge and straddle."

Don't think I'm mocking them: I think that's a great strategy, mainly because churning out PS/2 clones promises, near-to-mid-term, to be an *awful* business for the compatible-makers. No wonder many say they won't produce them (even while working feverishly on PS/2 designs in their R&D labs). Even Tandy and Dell seem to be backing away, if very quietly, from their announced plans.

IBM's 5 percent royalty for using PS/2 patents looks like the big reason, but that's just part of the equation. It's now apparent that how these compatible-makers will protect the rest of their product lines is more important than what that royalty does to vendors' cost structures.

CLONE VENDOR'S CONUNDRUM

Consider the dilemma of the PS/2 clone vendor. He already has an existing and at least reasonably successful AT-clone/286 product line: that's what got him to the point of considering a PS/2 clone.

And because everyone agrees that PS/2s generally and PS/2 clones specifically aren't going to be really important forces in the PC market for a while yet, he's got to protect the revenues on his existing "classic bus" machines. Or go down the tubes.



So as he sits down to price out his PS/2-clone line, he knows at least three things:

- To be attractive to customers, his PS/2-clone prices have to be significantly lower than the effective street prices for IBM's genuine article.
- He has to pay IBM a 5 percent royalty on the selling price of all PS/2-derived machines, making them much more costly for him.
- The prices for his PS/2 clones have to be significantly higher than the prices for his AT-clone line, to protect the classic-bus line from predation by the higher-cost but lower-margin PS/2 clones.

Say he's got a nice 10-MHz, zero-wait-state 286 machine, which with VGA card and monitor and a 20MB hard disk costs about $2,500 to $3,000. And maybe a nice 20-MHz 386, which with VGA card and monitor and a 40MB hard disk costs $5,000 to $6,000. Most name-brand clone vendors' lines fall in that range.

His new PS/2 clones will generally match those machines' performance. His PS/2 Model 50 clone will map to his existing 286; his PS/2 Model 80 compatible will approximate the performance of his 386 box. But of course his PS/2-like machines will cost more to build and sell, and they'll have to be priced significantly higher than those classic-bus machines they may seem destined to replace.

When the clone vendor finishes this little pricing exercise, and the new PS/2 clones are marked up to accommodate both his higher manufacturing costs and

Illustration: Mark Marcho

■ JIM SEYMOUR

that 5 percent royalty to IBM (and also to establish the kind of price/value relation that's needed to protect your existing classic-bus 286s and 386s), he finds to his utter horror that the proposed PS/2s come in at about $3,500 and $6,500 to $7,000, respectively.

Excuse me, but have you seen the current street prices on IBM PS/2s? You'll find 286 Model 50s for $3,000, 20-MHz Model 80s for $5,000, even the hot new Model 70 for $7,000—all with VGA on the motherboard and with IBM's very decent VGA monitor.

So please tell me how he thinks he's going to sell his PS/2 clones for those prices we just worked out.

He can't sell them for much less without destroying his cash-cow line. Yet he isn't even close to the 20 percent minimum discount off IBM's pricing he'll need to woo buyers away from Big Blue. Ergo, the PS/2 clone business is going to be a pretty lousy one.

■ Churning out PS/2 clones promises, near-to-mid-term, to be an awful business for the compatible-makers. No wonder many say they won't produce them.

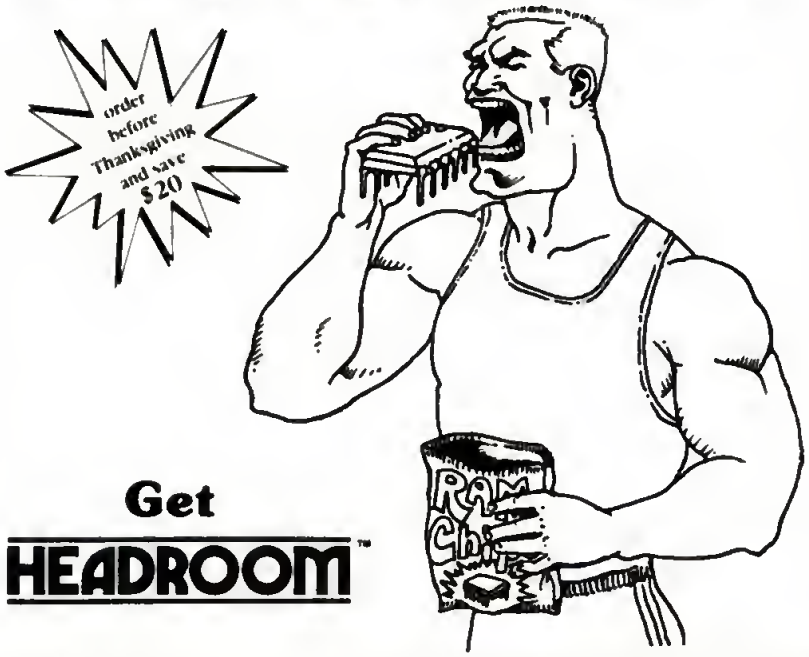
And I expect to see lots of well-established compatible-makers fighting just this conundrum over the next year. It won't be a pretty sight: there are no easy answers to this one.

IBM has picked price points for its PS/2s, and Big Blue has managed distribution so well (or *mis*managed distribution with a lucky outcome—you choose) that it has neatly sandwiched the compatible-makers between two unacceptable alternatives: pricing their PS/2 clones so high that they can't possibly compete against IBM's PS/2 prices, or else selling their classic-bus machines way too low, thus undermining the viability of their most important product lines.

Messy, huh? Not from IBM's standpoint. And hardly accidental.

A lot of clone-makers' management types must be thinking about paraphrasing the grumpy song of Oscar the Grouch: "PS/2s—You can't live wid 'em, you can't live widdoud 'em."

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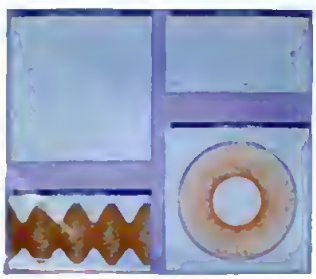
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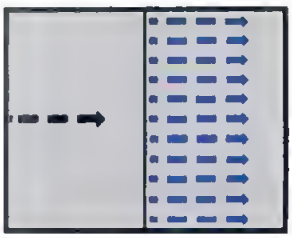


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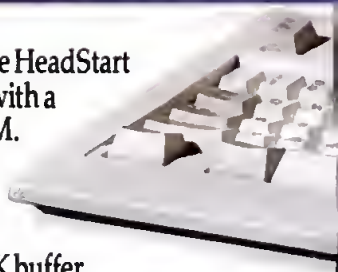
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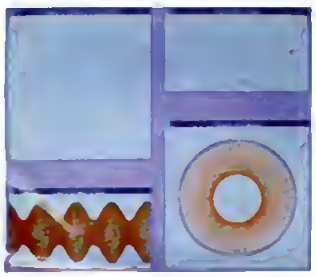
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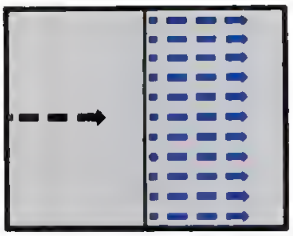


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■ STEPHEN MANES

"JUST TECH" VS. REALITY: WHO WINS?



Man does not live by technology alone—but try to tell that to those who think life without the hottest new machine or operating system is not worth living.

You can't walk across the street anymore without some half-crazed geek pointing a 386 laptop in your direction and mocking you with cries of "He still uses a five-slot PC!" You can't stop at a red light without some frenzied partisan frantically waving an "OS/2 Forever!" banner at you. Backed by freebooting marketeers, the disciples of Just Tech are at it again.

Just Tech is a mind-set, a philosophy, an attitude: the hermetic world of the engineer, the programmer, the consultant. Between it and reality—the rest of the universe—is the same "gulf of mutual incomprehension" C.P. Snow found between the literary intellectuals and scientists, his "two cultures." At its worst, Just Tech tends to focus blindly on technological questions and ignore the rest, particularly when it comes to costs—human, social, or financial.

Just Tech has three major axioms. The first equates feasibility with reasonableness: *If it can be done, it ought to be done.* The second confuses feasibility with reality: *If it's supposed to work, it works.* The third assumes technological superiority is the greatest good: *If it's technologically superior, it's absolutely superior.*

TECH HATH ITS CHARMS Just Tech's spirit of invention has undeniable charms. Its can-do bull-it-through-no-matter-what-the-odds approach can create breakthroughs that resonate with unimagined consequences, many of them happy. Dour realists say, "Man can't go to the moon." Just Tech sneers "Oh, no?"

But when the consequences are less pleasant, Just Tech tends to gloss over them. Just Tech fiascoes such as the space shuttle, the *Vincennes* incident, or nonfunctional weapons are always treated as rare exceptions, human stumbling blocks in the road to technological perfection. A tweak here, a patch there, and everything will be better than new.

JUST TECH ARROGANCE With computers, the Just Tech mind-set often leads to arrogant proclamations and hilariously inaccurate predictions based on the assumption that technological superiority will roll like a juggernaut over any obstacle. For years after IBM introduced the PC, you could always find dozens of Just Tech folk certain that the technical superiority of Unix or the p-System would lead to the eventual demise of DOS, that the "standard" S-100 bus would triumph over the lowly IBM PC's, or that the great advantages of the Motorola or National Semiconductor microprocessors would send Intel's chips to an early grave—blissfully ignoring such salient facts as the availability, price, and IBM seal of approval enjoyed by DOS, the PC bus, and the 8088.



Illustration: Mark Matcho

Now Just Tech flippantly consigns millions of users of 8088 (and even 286) machines to computer purgatory for failing to buy into the world of the 386, even when its benefits remain insignificant for many. Less than the latest and greatest simply will not do in the world of Just Tech; oblivious to such issues as cost and utility, Just Tech gravely ponders the relative technical merits of OS/2 or Unix and treats DOS as a bad joke. How anyone can put up with an old-fashioned, fourteenth-rate operating system simply because it happens to work is a mystery to Just Tech.

When there's no perceivable problem around, Just Tech stands ready to invent one. Thus we get fancy new motherboard designs intended to wring ten iotas more speed out of a machine and win this week's benchmark contest. The question of who might repair this one-of-a-kind watt-bumer when it goes on the fritz is beneath Just Tech's contempt.

Under the sway of Just Tech, programmers often design products simply because they know how to, not because the products fill any real need. Anyone who has had to sit politely through endless demonstrations of me-too software knows how seductively Just Tech justifies itself.

Just Tech also enjoys inventing technology accessible only to its adepts. New

■ STEPHEN MANES

printers come with fancy extra features; video boards offer half a dozen special high-resolution modes. The all-too-common catch: none of the goodies will work with any of the software you happen to own. Just Tech considers this no problem; all you have to do is write a driver. You mean you don't know how to write a driver? Just Tech wisdom finds it impossible to believe such a scurrilous rumor.

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Just Tech systems types often bite off more than they can chew, leaving customers with the bitter aftertaste. Just Tech always answers "Can do!" to a question such as "Could we network all our computers so that anyone in the company can instantly determine the status of our business?" Twelve months later, the can-do folks explain why the project is going to cost hundreds of thousands of dollars more than planned and end up being delivered 2 years late—just as management begins to realize that most of its employees never needed to know up-to-the-minute facts about the business in the first place.

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■ STEPHEN MANES

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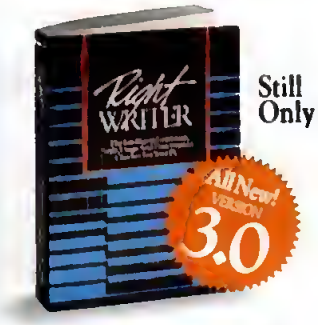
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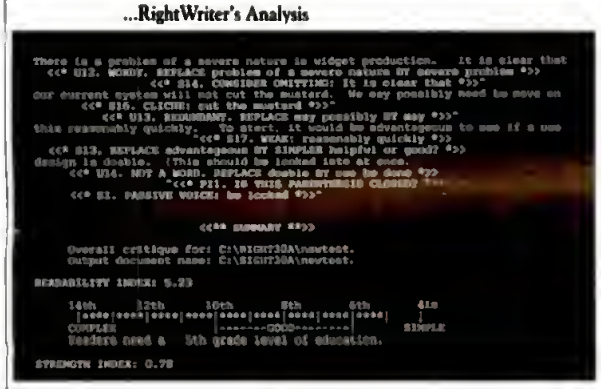
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Prime performance and small footprint are no longer mutually exclusive. The most recent crop of small-footprint 386 machines lets you reclaim your desk without sacrificing the benefits of 386 power. We found seven brand-new entries—three 16-MHz, three 20-MHz, and one 25-MHz screamer, the second-fastest machine we've ever tested—that will take up only a fraction of the space your lethargic XT does. In addition, American Mitac and IDR both introduced 20-MHz small-footprint 386s this year.

These streamlined machines offer what most people will need in a desktop computer and are ideal for processor-intensive tasks like spreadsheets, computer-aided design and engineering, graphics, multiuser applications, and multitasking. Because these small-footprint PCs have 386 functionality, you won't be excluded from using 32-bit environments such as *Windows/386* or Unix and multitasking environments like Concurrent DOS 386 and PC-MOS/386. And you'll see a big improvement in speed with the applications and environments you currently use in your day-to-day computing.

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WORKING AT THE SPEED OF RAM

Hardware manufacturers struggle with physics and affordability to create faster machines with today's available technology.

How fast a given computer can process a problem is governed by three major factors: the clock speed of the computer, the number of wait states imposed on every memory cycle, and the electrical arrangement of the memory. These three factors are not independent, but they are all interrelated and are united by the same goal—helping a high-speed microprocessor cope with low-speed memory while sacrificing as little performance as possible.

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The heat-imposed limit on microprocessor clock speed, quantified as the chip's speed rating, is actually higher than the fastest speed at which most memory chips can operate. Memory chips are limited in their speed potential by their designs, with two different designs prevailing.

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Because the microprocessor accomplishes nothing during a wait state, system performance slows down. The addition of one wait state will increase each memory access from three to four cycles, slowing the system by 33 percent.

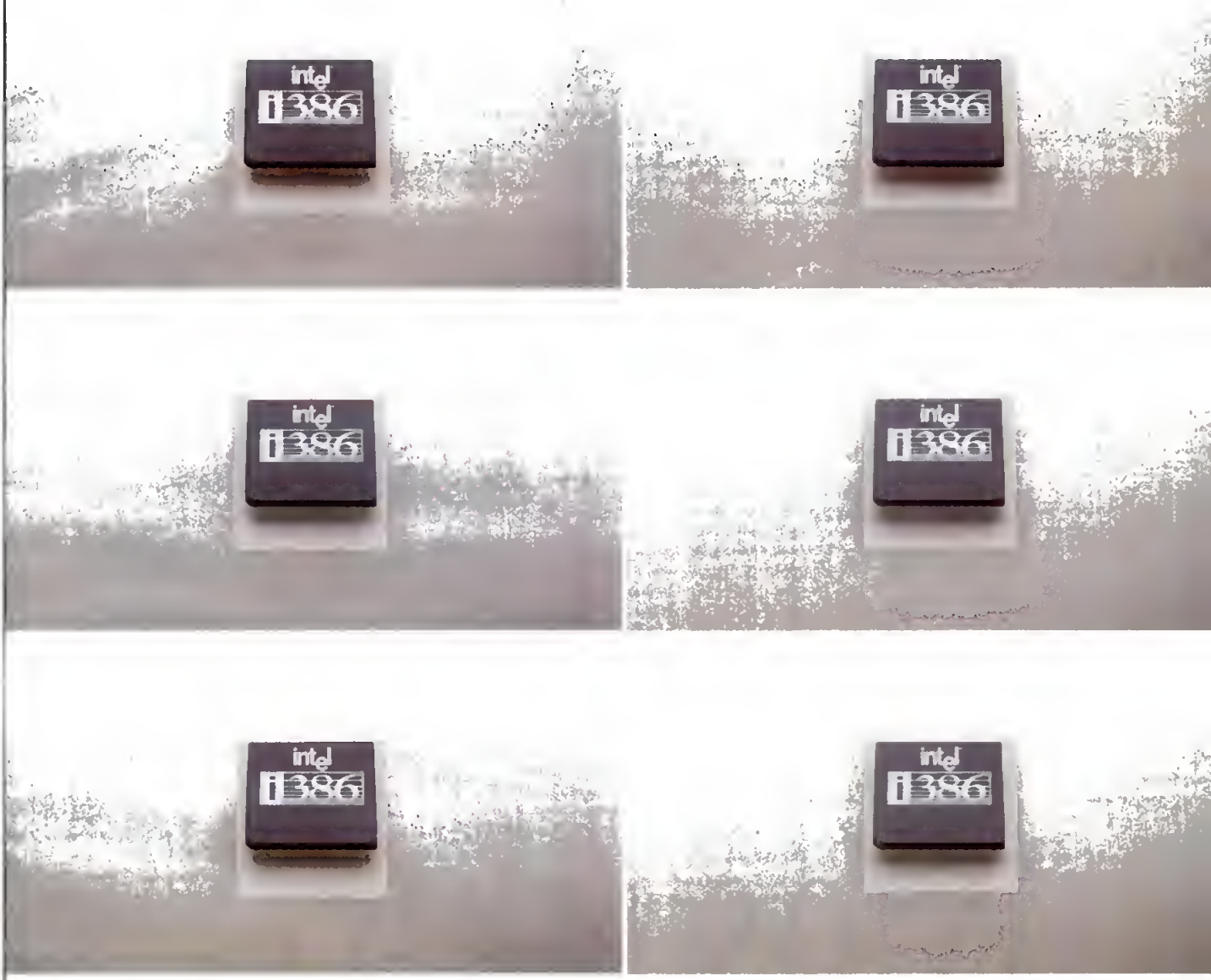
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THE SIZE IS RIGHT

PACKING 386 POWER INTO SLEEK PCs



Photographs: Roberto Brosan

Desktop real estate is almost as valuable as Manhattan real estate. If your desk space is less than unlimited, the battle for a place on your desktop is fierce. Until recently, if you wanted a small-footprint model you had to choose from a selection of lower-performance ATs; if you wanted speed and performance, you got one of the many behemoth 386 powerhouses that took over most of your desk and pushed just about everything else onto the floor.

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THE GOLD STANDARD

Width is the most important size consideration with a small-footprint machine. The machines reviewed here range from the IBM PS/2 Model 70's width of 14¼ inches to the Arche Rival 386's 17 inches, compared with the IBM PC AT's 21-inch width. Although the depth is also a factor in desktop size, it is not nearly as important as the width. And while the models we've reviewed take up less desk space, their keyboards are often wider than the system units.

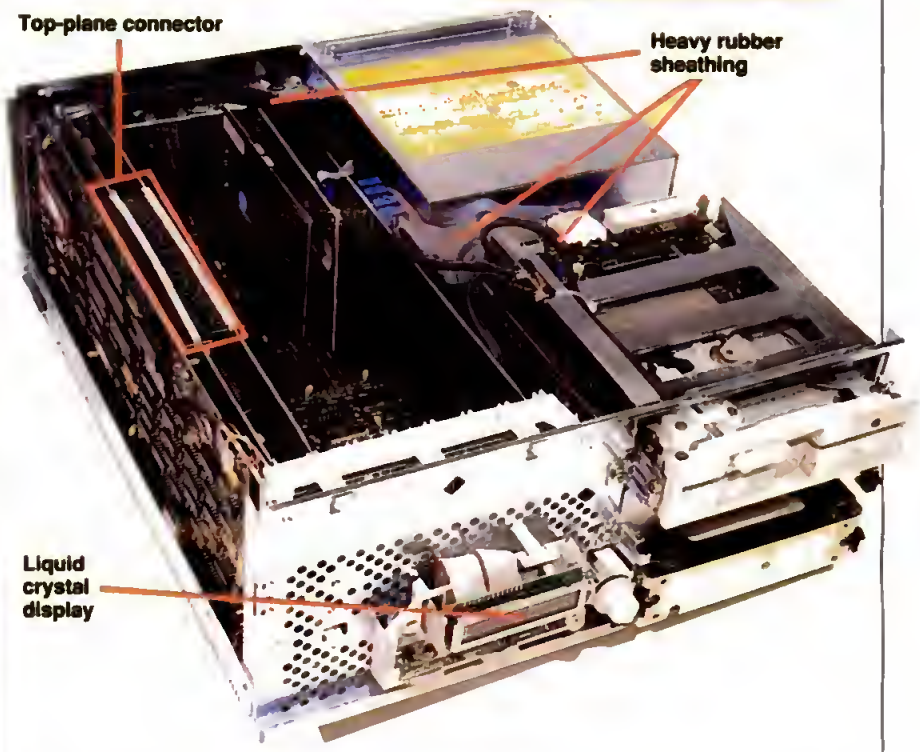
In this story we look at the 16-MHz Amdek System/386, the 10/20-MHz Arche Rival 386, the 16-MHz Compaq Deskpro 386S, IBM's PS/2 Model 70 lineup of three 386 Micro Channel machines (16, 20, and 25 MHz), and the 20-MHz Normerel ATC-386. The manufacturers of these machines have taken different approaches to packing 386 power into a bantam box. As you examine the features of these machines, take note of the number of slots the motherboard saves. Does the system board include I/O ports, video, memory expansion potential, and floppy/hard disk controller? If the basics are on the motherboard, then three or four expansion slots will probably be enough. For instance, the Compaq Deskpro 386S starts out with only four slots, but none of these will be needed for the basics; VGA, memory expansion, hard disk controller, and I/O ports are designed onto the system board.

The reviews that follow prove the old adage—good things do come in small packages.—**Catherine D. Miller**

AMDEK SYSTEM/386

The $6,020 Amdek System/386 runs at 16 MHz and comes with a 40MB hard disk, VGA monitor, and 1MB RAM. The computer features a **top-plane connector** that implements 32-bit processing, serving as a RAM bus extension between the system and memory boards. Note how one of the two 16-bit cards is connected to the top-plane connector from above rather than from below. The **heavy rubber sheathing** protects the cables from heat and shock. The **liquid crystal display (LCD)**, programmable to 16 characters, allows users to display time and date or any other message.





AMDEK CORP.

Amdek System/386

Talk to anyone at Amdek about the company's computer systems and the word *modularity* is bound to come up at some point in the conversation. Derived from Modular Systems Architecture (MSA), modularity is the "concept" behind Amdek's line of 8088, 80286, and 80386 desktops and workstations. This notion simply means building a box with a baseboard that provides enough 8- and 16-bit slots to allow an easy (and proprietary) upgrade and expansion path. Going from 286 to 386 computing or taking the system RAM from 2MB to 6MB is no more troublesome than mounting a card and configuring your system to accept it.

Amdek, a company long known for its monitors and owned by Wyse Technologies since 1986, has laid out the guts of its 6¼- by 15- by 17-inch Amdek System/386 in an open, distinctively clean way that makes the most of its tight internal space. Inside you get zero-wait-state 16-MHz processing (switchable to 8MHz with 1 wait state), 1MB of 32-bit interleaved static column RAM (expandable to 2MB), two serial ports, one parallel port, six 16-bit slots, two 8-bit slots, a rack that holds three half-height drives (a 1.2MB floppy with dual controller come standard), and a 190-watt power supply.

The designers of the System/386 have implemented a full 32-bit bus running at 16 MHz through the top-plane connector. This connector is a memory-only bridge, or RAM bus extension, between the system and memory boards. Up to two additional memory boards, holding 2MB each, can be added. The cards, mounted with 256K chips, don't come cheap, at $1,695 each. However, boards are available without chips for $395 (including an expanded

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Priscilla Tate-Austin is a senior editor of *PC Magazine*.

top-plane connector) if you happen to have a cheaper source of memory chips than Amdek. A 2MB upgrade from Amdek will run $695, so if you do it yourself, you can boost memory for $1,090 a board. The company is working on an 8MB card mounted with 1MB SIMMs to be available this fall.

What Amdek calls the motherboard also has a piggyback daughtercard. Both occupy the two leftmost slots on the baseboard. Because of the vertical architecture of the small-footprint System/386, the term *motherboard* is really a misnomer—but that's just semantics. Its function as the system board is undeniable. It holds the 32-bit 80386 chip, sockets for a 10-MHz 80287 or 16-MHz 80387 math coprocessor, and a proprietary Phoenix ROM BIOS that has an expanded drive table for 50 drive types, including hard disks of up to 256MB. The daughtercard holds the display adapter jumper along with the battery and speaker connectors. The company is experimenting with Intel's 386SX chip, but Amdek is more likely to release system boards mounted with faster and (eventually) larger chips.

VERTICAL INTEGRATION Essentially all the components, with the exception of the Western Digital drive controller, Control Data fixed disk, Cherry keyboard and Mitsubishi floppy disk drive, are Wyse components. Even the power supply is Wyse. It's all part of another concept translated by the folks at Amdek as vertical integration. The principle: build all the elements, cut out the middleman, and deliver minus the markup. In the case of the System/386, the delivery comes from Taiwan, where the machines are manufactured.

On the outside of the machine, the power switch and clock speed toggle are right up front. The face of the box also has an LCD panel—programmable for up to 16 characters—that serves as a handy display for the date and time. The AT-style keyboard is a mechanical keyswitch manufactured by Cherry and is the same unit shipped on all Wyse terminals.

Not surprisingly, the System/386 sent for review came configured with an Amdek MCGA/VGA-compatible monitor and video card mounted with the Tseng Labs chip set. The $625 Amdek Monitor/732 is a 12-inch nonglare analog display with a maximum 640- by 480-pixel resolution in graphics mode and 720 by 400 in text mode. It's a quality monitor with crisp dot pitch and sharp colors. Coupled with the Amdek VGA Adapter/132 half-card, the Monitor/732 is compatible with IBM's VGA standard, but a slow performer on the PC Labs video tests.

The VGA Adapter/132 comes with drivers that let *Lotus 1-2-3*, *AutoCAD*, *GEM*, *Ventura Publisher*, and *Microsoft Windows* use 132-column screens. Although the *Windows* screen drivers are rated for *Windows/286* and */386*, Version 2.1 of the 386 program would not run past the installation setup screen. Technicians at Amdek investigated and advised that Tseng Labs will be making changes in the video BIOS to correct the problem. *Windows/286* runs without difficulty as does Release 2.0 of *1-2-3*, both at 132 columns and at the default column setting. Included with the drivers is a needed utility called FASTBIOS, which copies the VGA BIOS information into memory for faster access at RAM speeds. In many ways, this software utility is similar to the firmware shadow-RAM feature now found in many system ROM BIOS chips used by 386 manufacturers. While Amdek hasn't built it into its proprietary Phoenix chips, shadow RAM may become a part of future versions of its system BIOS chips.

Aside from the video utilities shipped with the tested System/386, there are several programs and utilities that come standard with the machine. This software includes the setup disk, LIM EMS and EEMS emulator software, and a disk defragger. Of note, the MS-DOS 3.2 supplemental disk has two utilities, CACHE and HELP, which enhance performance for day-to-day use.

By now, most PC users know the high value of memory-caching programs. There are many commercial programs out on the market, and nearly all manufacturers supply either utilities or disk caching controllers with their systems. Amdek's CACHE is a straightforward, easy-to-set-up program. It directly reserves a portion of conventional or extended memory to hold copies of the contents of frequently accessed disk sectors. The parameters used with the command CACHE turn the cache on for the designated drives, set the cache's location, and specify the amount of memory to be dedicated. Once loaded (at 256K in extended memory), CACHE improved on an already hot performance on the PC Labs DOS File Access benchmark test by nearly 9 seconds.

HELP is a nice-touch utility that gives you on-line assistance with a variety of DOS commands, configuration statements, and special utilities. For example, if you don't know how to relocate the cache in extended memory above 1MB, just type HELP CACHE. A series of screens pops up, citing usage and syntax in

FACT FILE

Amdek System/386
Amdek Corp.
1901 Zanker Rd.
San Jose, CA 95112
(800) PC-AMDEK
(408) 436-8570
List Price: With 1MB RAM, 1.2MB floppy disk drive, $3,850; with 40MB hard disk, $4,950; 2MB RAM expansion card, $1695; Amdek VGA Adapter/(CGA, EGA, VGA, extended VGA), $445; Amdek Monitor/A732, $625; OS/2 with LCD support and dual boot capability, $325.
In Short: The Amdek System/386 is a smart buy for the private and corporate purchaser who's in the market for a small-footprint IBM compatible. Performance is right up there with the industry leaders. Both Amdek and its parent, Wyse, have been around for a while. They use reliable authorized dealers and are not likely to fade away. This computer is just one part of a systems-wide stable of personal computer products.

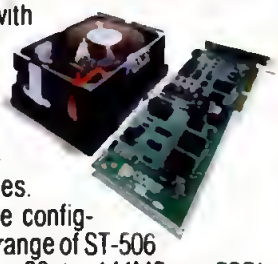
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Benchmark Tests: Small-Footprint 386 Computers

Our roundup of small-footprint PCs includes both big names and new competitors. From IBM, PC Labs tested the trio of PS/2 Model 70s: the 16-MHz Model 70-E61, the 20-MHz Model 70-121, and the 25-MHz Model 70-A21. Compaq's entry, the Deskpro 386S, runs at 16 MHz and features the Intel 386SX microprocessor chip. Amdek, well known for monitors, produces the Amdek System/386, able to run at 8 and 16 MHz. The Arche Rival 386 is a 20-MHz machine, and Normerel's ATC-386 runs at a clock speed of 20 MHz.

Of the machines reviewed the IBM PS/2 Model 70-A21 was tops in the 80386 Instruction Mix, an indicator of processor speed. In addition to the fast clock speed, the 70-A21 has an 82385 cache controller card and uses a 64K static-RAM cache. Normerel's 20-MHz ATC-386 takes second place, optimizing its performance with memory interleaving and zero-wait-state operation. Third in line is the Arche Rival 386. Although the Arche doesn't have memory caching, its use of 100-nanosecond DRAM chips plus Phoenix's shadow RAM system and video BIOS make it a serious contender overall.

Running neck and neck with the Arche computer is the 20-MHz IBM PS/2 Model 70-121, with zero to two wait states. And the Amdek System/386 is no slouch, with optional zero-wait-state operation and a 16-MHz clock speed.

Those players appear in nearly the same order on the NOP and Floating-Point Calculation tests (where the IBM PS/2 Model 70-121 has moved up to second place). These tests measure clock and processor speed, so the enhancements mentioned above still help. The same expectation holds for the Conventional Memory test, where reads and writes are performed; a faster clock speed and fewer wait states produce better statistics.

The Extended Memory test scores seem to follow a different pattern. Perticularly unusual is the Arche Rival 386, the machine that reported the slowest times. In response to our query, Arche attributed the slow times to the amount of overhead operation required when repeatedly switching from real to protected mode and back. The company is experimenting with a new BIOS to compensate for this phenomenon.

Those computers with software caching generally improved on their unenhanced times in the DOS File Access tests for small and large records, with the most dramatic results appearing on the small-record test. The Amdek System/386, Compaq Deskpro 386S, Normerel ATC-386, and IBM PS/2 Models 70-A21, 70-121, and 70-E61 all had software caching available.

Turning to the BIOS Disk Seek test, it becomes obvious that hard disks heve still not caught up with the processors' enormous speed leaps. In fact, the Arche Rival 386, using a Seagate hard disk, was slower than the IBM PC AT. Normerel's ATC-386, with a faster SCSI hard drive, could not run the BIOS Disk Seek test, because SCSI technology doesn't use standard IBM BIOS calls.

Our video tests produced one clear winner: the Compaq Deskpro 386S. Compaq's 16-bit VGA controller and memory chips are on the system board, and the computer has proven its speed in previous *PC Magazine* video tests. The three IBM PS/2 Model 70s also had video capability on the system board, but didn't perform as well on the Direct to Screen test.

Performance Times
(Times given in seconds except where noted)

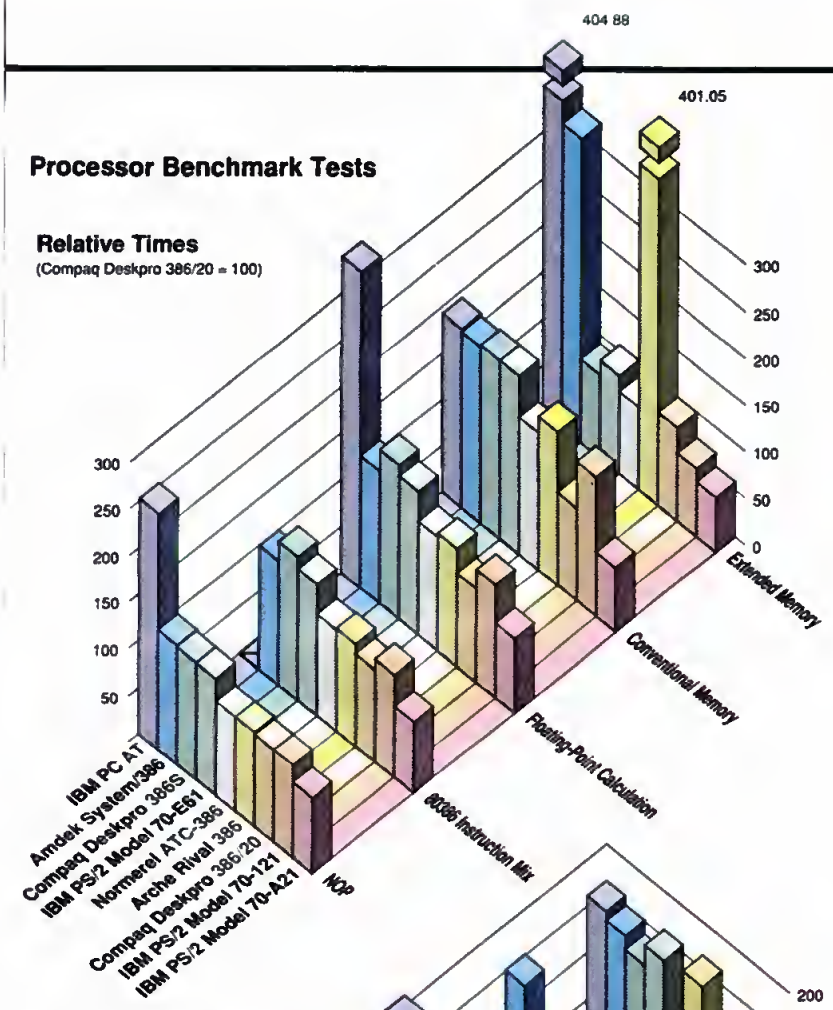
	Processor Benchmark Tests					Disk Benchmark Tests				
	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	Extended Memory	DOS File Access (small record)	DOS File Access (small record) with cache	DOS File Access (large record)	DOS File Access (large record) with cache	BIOS Disk Seek (milliseconds)
IBM PC AT (8 MHz)	4.17	N/A*	35.60	0.77	11.62	72.63	N/A§	19.74	N/A§	29.20
Amdek System/386 (16 MHz)	2.11	3.87	14.94	0.78	9.34	48.00	36.93	17.53	17.38	27.42
Compaq Deskpro 386S (16 MHz)	2.09	4.48	17.37	0.77	2.60	62.86	37.54	7.54	6.97	24.72
IBM PS/2 Model 70-E61 (16 MHz)	2.09	4.11	16.14	0.77	3.05	78.08	43.89	9.05	8.32	28.64
Normerel ATC-386 (20 MHz)	1.69	3.15	12.86	0.59	2.56	74.15	73.65	14.97	14.69	N/A¶
Arche Rival 386 (20 MHz)	1.69	3.20	13.30	0.66	11.51	53.69	N/A§	17.58	N/A§	29.80
Compaq Deskpro 386/20 (20 MHz)	1.65	2.91	10.50	0.40	2.87	56.78	34.14	9.34	9.40	18.10
IBM PS/2 Model 70-121 (20 MHz)	1.65	3.24	12.69	0.60	2.09	71.16	39.62	6.54	6.49	23.60
IBM PS/2 Model 70-A21 (25 MHz)	1.34	2.25	8.34	0.28	1.68	71.49	38.69	6.53	6.49	23.44

N/A*—Not applicable: the IBM PC AT is an 80286-based computer. N/A§—Not applicable: this computer has no disk caching.
N/A¶—Not applicable: the Normerel ATC-386 has an SCSI hard drive.

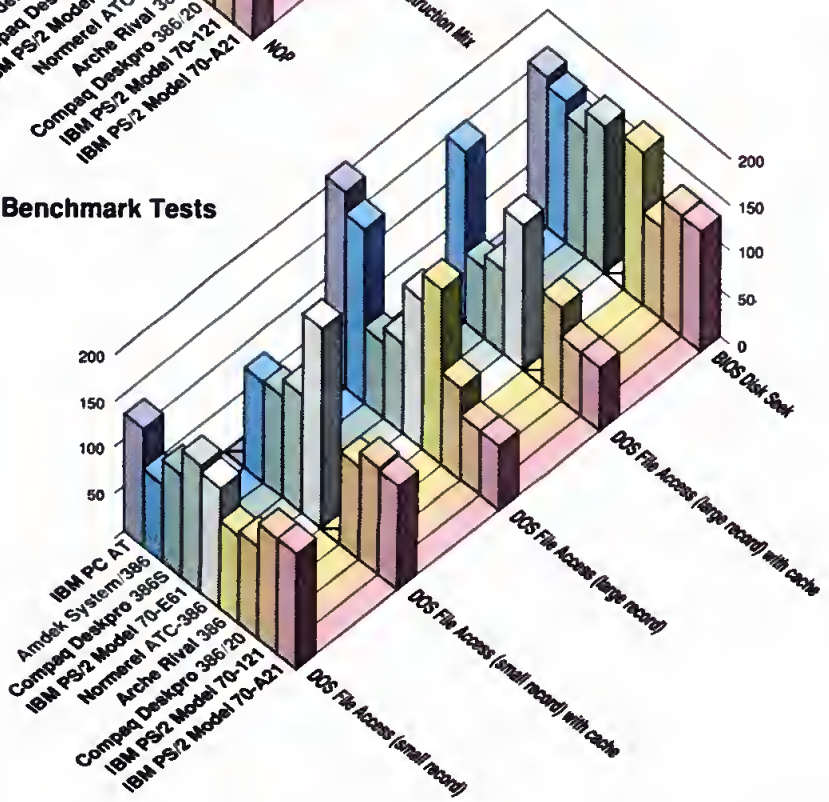
Processor Benchmark Tests

Relative Times

(Compaq Deskpro 386/20 = 100)



Disk Benchmark Tests



The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **Extended Memory** benchmark test allocates 256K of extended memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

If no disk caching software is supplied by the computer or disk drive manufacturer, each test is run once. Otherwise, the test for each record size is run twice: once with the caching software installed and once without it.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

(continues)



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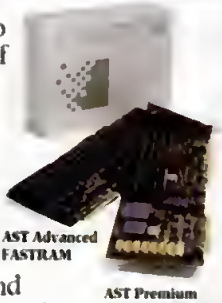
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CPU speed (MHz)	10, 8, 6	10	12, 8
Wait States	0	0	1
Max. 0 Wait-State Memory	16 MB	2 MB	0 MB
Expanded Memory	EEMS EMS 4.0 Included	Extra Cost	Extra Cost
Hard Disk Size Speed	40 MB 28ms	30 MB 39ms	40 MB 28ms
DOS 3.3 and GW-BASIC®	Included	Extra Cost	Extra Cost
Easy 386 CPU Upgradeability	Yes	No	No

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*PC Digest, May 1988 Independent Comparative Ratings Report for selecting PC Systems and Peripherals

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Benchmark Tests: Small-Footprint 386 Computers

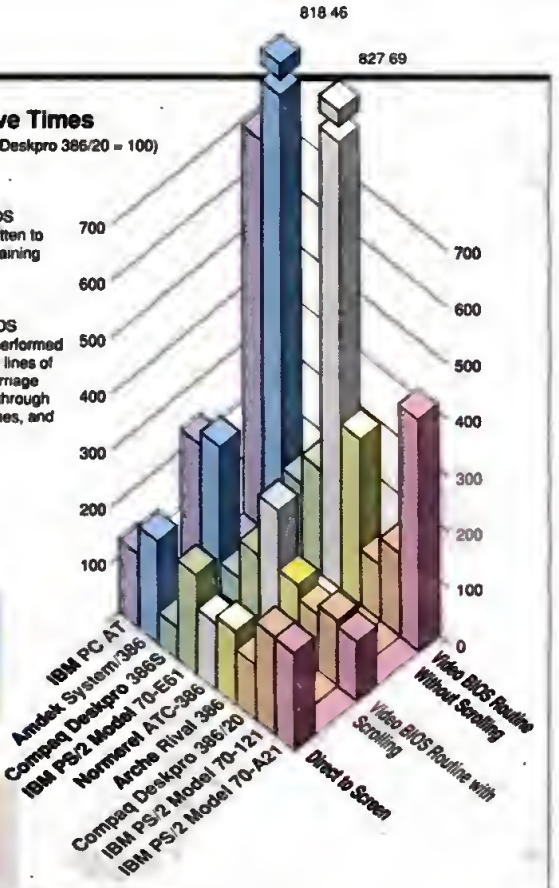
The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

Video Benchmark Tests

Performance Tests (Times given in seconds)	Direct to Screen	Video BIOS Routine with Scrolling	Video BIOS Routine Without Scrolling
IBM PC AT (8 MHz)	4.90	7.60	4.50
Amdek System/386 (16 MHz)	6.79	8.36	5.32
Compaq Deskpro 386S (16 MHz)	2.06	1.76	0.88
IBM PS/2 Model 70-E61 (16 MHz)	6.57	3.97	1.21
Normerel ATC-386 (20 MHz)	4.34	7.42	5.38
Arche Rival 386 (20 MHz)	4.85	3.99	1.92
Compaq Deskpro 386/20 (20 MHz)	3.70	3.20	0.65
IBM PS/2 Model 70-121 (20 MHz)	6.54	3.71	0.97
IBM PS/2 Model 70-A21 (25 MHz)	6.53	3.43	2.69



the format of DOS manual pages. You may not use it much, but it'll be there when you need to do something really complicated like installing the VMEM.SYS with its correct parameters.

Across the board, the Amdek System/386 is a solid machine, aimed clearly at the desktop market. Aside from its slow video performance without the FASTBIOS utility enabled, the machine held its own against the Compaq Deskpro 386S. For the price, it's competitive with any 386 out there.—**Greg Pastrick**

ARCHE TECHNOLOGIES INC.

Arche Rival 386

If you're thinking the name sounds familiar, you're right. The Arche Rival 286 earned an Editor's Choice in our review of nine AT-class computers in the July issue ("The Niche Factor: Nine ATs Compete for Market Share," *PC Magazine*, July 1988). Like its 286 cousin, the Rival 386 is a well-designed computer—this time packing 20-MHz performance into an XT-size chassis.

Arche designs and manufactures all of its own components here in the United States. In fact, the heart of this machine is Arche's own motherboard design, the PAT386. Sporting a 20-MHz Intel 80386 microprocessor that is keyboard switchable between 10 and 20 MHz, this board uses the Chips and Technologies eight-chip VLSI circuit set and has eight expansion slots: two 32-bit, two 8-bit, and four 16-bit.

The motherboard itself has no on-board RAM and does not include any serial or parallel ports. One of the two 32-bit slots in the base system contains Arche's 32-bit memory card, configured with 2MB of two-way interleaved 100-nanosecond DRAM. The use of 100-ns. chips is surprising since the Rival 386 has no memory-caching capabilities. Many manufacturers of 20-MHz 80386 systems use chips rated at 85 ns. or better when a memory-caching technique is not employed.

Memory can ultimately be expanded to 16MB by filling both 32-bit slots with Arche's 8MB memory boards. (A trade-up plan for current owners of the 2MB board is in the works.) The Phoenix BIOS provided with the machine can be set to automatically move the system BIOS and EGA BIOS from slow 16-bit ROM into fast 32-bit RAM. The setup software that came with the system is disk-based and particularly easy to use.

CHANGEABLE COPROCESSORS

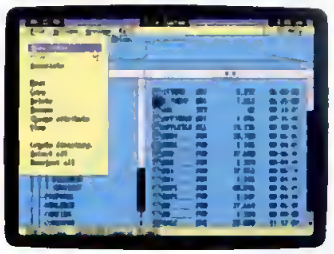
One interesting feature on the PAT386 is Arche's custom-designed PGA (pin grid array) socket which accepts either an 80287 or 80387 math coprocessor. Changing from one coprocessor to the other simply involves replacing the chip and changing one jumper.

The standard configuration of the Rival 386 comes with five of the eight slots occupied. While one of the 32-bit slots holds the 2MB memory card, an 8-bit slot is occupied by the standard monochrome

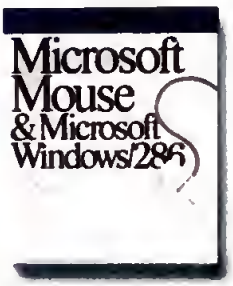
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Literally hundreds of applications support the Mouse. But as the leading software developer for personal computers (and one of the first to bring a graphical interface to PC screens), we've gone a step further: Microsoft Windows/286 with PC Paintbrush® for Windows, Microsoft Paintbrush or EasyCAD™2 actually come with the Mouse (or vice versa).

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But it's the Microsoft Mouse that puts you in the driver's seat.

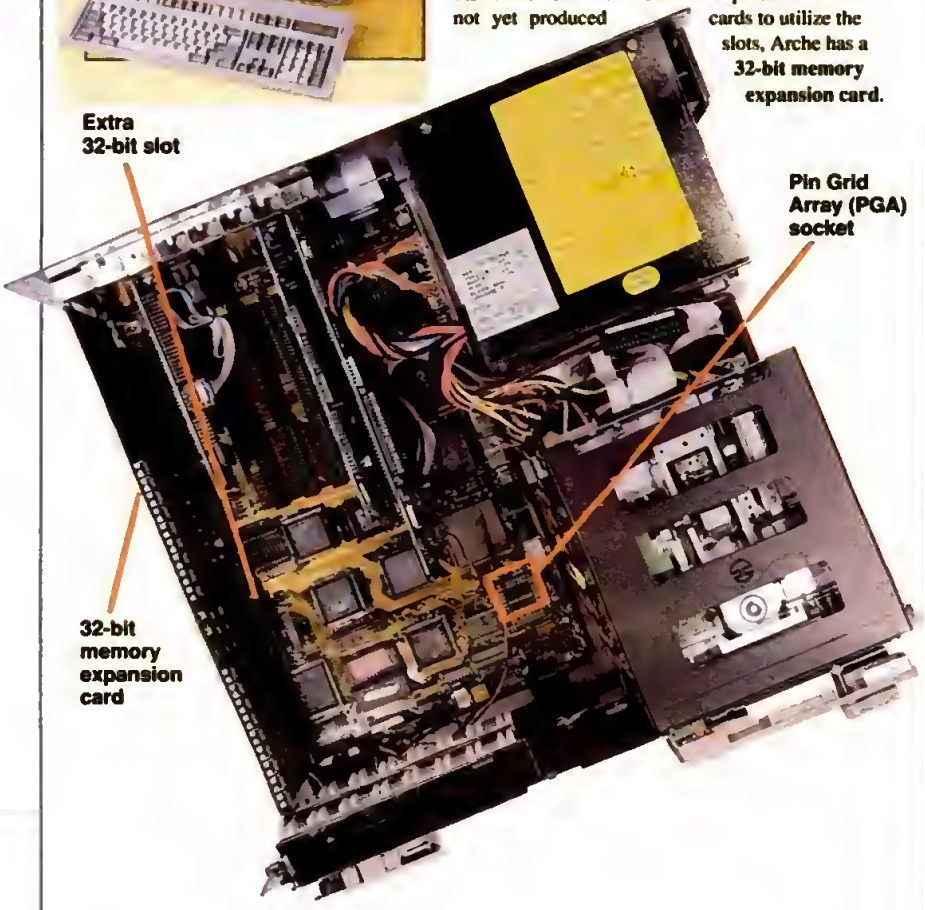
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ARCHE RIVAL 386

The Arche Rival 386 is sluggish for a 20-MHz machine, but the $5,190 price tag includes 2MB RAM, a 40MB hard disk, and a 14-inch monochrome monitor that comes standard even in the basic configuration. The combination Pin Grid Array (PGA)/DIP socket allows for the installation of either an 80287 or an 80387 math coprocessor. Unlike many other manufacturers, who provide 32-bit slots in their 386 computers but have not yet produced cards to utilize the slots, Arche has a 32-bit memory expansion card.



PC MAGAZINE FACT FILE

Arche Rival 386
Arche Technologies Inc.
48835 Kato Rd.
Fremont, CA 94539
(800) 422-4674
List Price: With 2MB RAM, 1.2MB 5¼-inch floppy disk drive, 14-inch flat-screen amber display, $4,395; with 14-inch paper-white flat-screen display, $4,430; with EGA monitor and card, $4,995; 2MB RAM expansion, $1,221; 80387 coprocessor, $875; 360K 5¼-inch floppy disk drive, $139; 720K 3½-inch floppy disk drive, $199; 1.44MB 3½-inch floppy disk drive, $249; 28-ms. 40MB hard disk, $795; 28-ms. 71MB hard disk, $1,495; 28-ms. 95MB hard disk, $1,795.
In Short: The Arche Rival 386's benchmark-test results may not leave other 20-MHz computers in the dust, but it's a well-priced competitor with two 32-bit slots, and ports to spare. The Rival 386 achieves a small footprint without sacrificing much expandability and boasts an extra-long 2-year limited warranty.
CIRCLE 084 ON READER SERVICE CARD

graphics/parallel printer adapter, which is Hercules compatible. The standard monitor, furnished with the system even if you elect to buy a color monitor, is a very attractive 14-inch, high-resolution, flat-screen, amber display.

A second 8-bit slot is occupied by the Arche parallel/serial adapter, which provides a second parallel port as well as two serial ports. The second of these two serial ports extends via ribbon cable from the card to occupy one of the other slot openings in the back of the case.

The Arche UDC disk controller card occupies one of the 16-bit slots and is capable of controlling four disk storage devices, although there is room for only three half-height devices in the drive bays.

The review unit contained a Teac 1.2MB floppy disk drive, an optional Seagate ST-251 40MB hard drive, and a Sony 1.44MB floppy disk drive (also optional). The Sony drive worked especially well in transferring files between the Arche and the IBM PS/2s in PC Labs. The 200-watt power supply is made by Sentron and has four device connectors.

Included in the base system price of $4,395 are MS-DOS 3.3 and GW-BASIC. Arche does not currently offer its own version of OS/2 and has not determined whether the company will offer one in the future.

A VARIETY OF PORTS In most small-footprint machines, achieving the small size exacts a price. In most cases the number of expansion slots is cut and drive space is reduced, producing a machine with limited expandability. The Rival 386 comes standard with one 32-bit slot and two 16-bit slots available for expansion (actually three if you count the one slot whose connector opening is occupied by the second serial port), and room for three half-height devices. With two serial and two parallel ports as standard equipment, you won't find yourself "expanding" just to be able to run a mouse and modem together.



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A nice touch regarding the serial ports is that one is a 9-pin AT-type while the other is the old XT-standard 25-pin connector. It's a handy bonus for those of us who have found ourselves with mismatched equipment. A DB9-to-DB25 converter is included in the box as well.

The Rival 386's XT-size cabinet, a space-saving 6 by 17 by 16.5 inches (HWD), is attractively designed. A reset switch on the front panel provides an easy escape from those situations in which even the old standby Ctrl-Alt-Del won't produce a warm boot. An LCD clearly shows the current clock speed.

The power switch is located in the back on the right side of the case, XT style. Currently the Rival 386 has only attained a Class A FCC rating, although Arche is working on the more rigorous Class B certification.

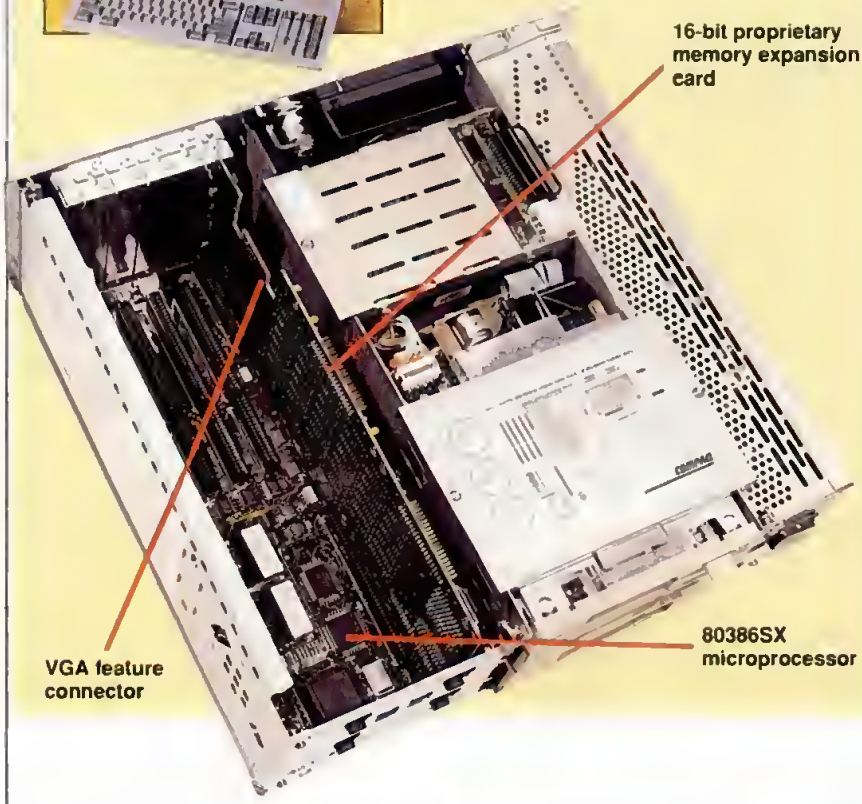
The documentation provided with the system consists of a user guide as well as several manuals covering each of the component boards installed in the system, such as the video adapter and disk controller. The user guide is well written, well illustrated, and tailored to the inexperienced purchaser. Arche's 2-year limited warranty is another welcome bonus.

While the Rival 386 didn't come out ahead of its fellow 20-MHz competitors in any of PC Labs benchmark tests, it didn't fare poorly either. Arche could speed up an already speedy 386 by using faster memory chips and incorporating a static RAM cache. And while this machine certainly won't compete with today's high-powered, tower-configuration file servers, it fares well as a high-speed workstation—and a small-footprint step into 386 technology.—**Salvatore P. Ricciardi**



COMPAQ DESKPRO 386S

Based on the 80386SX chip, the 16-MHz Compaq Deskpro 386S sells for $5,898 with 1MB RAM, 40MB hard disk, and VGA monitor. In addition to up to 13MB of RAM, the **16-bit proprietary memory expansion card** includes the **VGA feature connector**. The **80386SX microprocessor** provides performance comparable to that of a 386, while allowing a price only slightly higher than what Compaq charges for 286 models.



COMPAQ COMPUTER CORP.

Compaq Deskpro 386S

With its recent introduction of two new 386 computers—the Deskpro 386/25 and Deskpro 386S—Compaq Computer Corp. declared that it was widening the range of 386 technology, not just advancing it. No doubt that's true: the 386/25, along with a number of other lightning-fast 25-MHz machines, redefines the upper limit of PC speed—at least for now; the small-footprint 16-MHz 386S, the first and, to date, only PC based on the new 16-bit Intel 80386SX microprocessor chip, reestablishes the midrange of processing power by offering 32-bit functionality at a 286 price. It's the latter machine that you can't afford to overlook if you think your budget precludes the purchase of an 80386-based machine.

Priced at $3,799 ($4,499 with a 20MB hard disk; $5,199 with a 40MB hard disk), the Deskpro 386S features 32-bit internal operation and 16-bit external operation; it processes data at 32 bits per CPU cycle and supports 16-bit memory expansion and an 8-/16-bit expansion bus. The machine competes head-to-head with IBM's small-footprint 10-MHz PS/2 Model 50 and Dell's 20-MHz System 220. In terms of performance, the 386s blows away the notoriously slow Model 50 on all of the PC Labs benchmark tests but can't catch up with the sleek and considerably cheaper System 220 on several tests. (To compare the actual test results for those machines, see John Dickinson's article, "Compaq's 386S: Less Is More," *PC Magazine*, August 1988.) You may get faster performance from the Dell System 220 or similar AT-compatibles than you will from the Deskpro 386S, but because you won't be

PC MAGAZINE FACT FILE

Compaq Deskpro 386S
Compaq Computer Corp.
20555 FM 149
Houston, TX 77070
(713) 370-0670
List Price: Model 1, with 1MB RAM, 1.2MB floppy disk drive, Compaq Enhanced Keyboard, $3,799; Model 20, with 20MB hard disk, $4,499; Model 40, with 40MB hard disk, $5,199; 1MB memory module, $799; 4MB memory module, $2,999; 1MB memory expansion board, $799; 4MB memory expansion board, $2,999; VGA monitor (no card needed; basic configuration supports VGA), $699, 80387 coprocessor, $799; 40MB tape drive, $799; 135MB tape drive, $1,999; asynchronous parallel printer board, $149; 110MB hard drive, $3,499.
In Short: Marketed as a more powerful alternative to 286 computers, this small-footprint 16-MHz machine based on the new Intel 386SX microprocessor features 32-bit internal and 16-bit external operations, built-in VGA graphics, four full-length expansion slots, and an addtional proprietary memory-expansion slot for boosting RAM to 13MB. Its intelligent and economical design, host of standard features, and good performance make the Deskpro 386S an ideal midrange choice.
CIRCLE 683 ON READER SERVICE CARD

able to run programs like *Microsoft Windows/386*, Quarterdeck's *DESQview*, or *VM/386* to multitask your DOS applications, you'll be losing out on the 386 chip's processing advantage.

In this round of tests, the Compaq Deskpro 386S performed the 80386 Instruction Mix benchmark test in 4.47 seconds, executing a series of processor-intensive tasks approximately 2 seconds slower than the 25-MHz IBM Model 70, the fastest small-footprint 386 machine that we evaluated. The 40MB Connor ESDI disk drive that came with our evaluation unit completed the BIOS Disk Seek test in 24.72 milliseconds, besting its own rated access time by 4 milliseconds. (Connor also manufactures the Compaq Portable 386's hard disk drive, which has garnered a good reputation for both strong performance and reliability.) The unit finished the DOS File Access (small record) benchmark test in 62.85 seconds without using Compaq's disk-caching software, and in 39.24 seconds with caching.

The Deskpro 386S's host of standard features and four full-length, 16-bit expansion slots mean that you won't have to give up functionality to discover anew the surface of your desk: Compaq has been able to find room in the 386S's 5.9- by 15.8- by 14.8-inch (HWD) system unit for just about anything you could want. Whether you choose the 20MB or 40MB model or decide to buy the diskless unit and add to it an optional 110MB drive ($3,499), you'll be able to use one of two one-third–height device slots for a second hard disk.

Occupying the third device slot is a one-third–height 1.2MB 5¼-inch floppy disk drive, which comes standard on all three Deskpro 386S models. Also standard are 1MB of 100-nanosecond RAM on the system board, the Compaq 101-key enhanced keyboard, and the Compaq Expanded Memory Manager, which is a device driver that controls LIM 4.0 expanded memory and applications that use expanded memory. Other storage options include a 1.44MB 3½-inch disk drive ($245) and a 40MB ($799) or 135MB ($1,999) tape backup unit.

In theory, the Deskpro 386S's system unit and 1.7- by 18.5- by 7-inch (HWD) keyboard are small enough to sit on the L-shaped return of a secretary's desk. In practice, though, unless you don't mind balancing your keyboard on your lap as you type, you'll be better off placing the unit on your desktop. I found the keyboard to be responsive, solid, and comfortable to use. On the rear panel of the system unit, you'll find a parallel port, serial port, and a PS/2-compatible mouse port, all of which are identified by icons. Compaq also chose to place a security lock on the back panel—a less than accessible spot.

SLOT-SAVING DAUGHTERBOARDS

Right out of the box the Deskpro 386S is set to run VGA, making use of a 16-bit VGA daughterboard that is based on the Paradise chip set. You won't find a VGA Feature Connector on the daughterboard. Instead, it resides on Compaq's proprietary memory expansion card, an add-in board that, in increments of 1MB and 4MB, can bring your RAM up to 13MB. Both the VGA daughterboard and the proprietary memory expansion card are slot savers: you won't have to give up an expansion slot to get VGA's high resolution and brilliant palette or to get the extra RAM you'll need to run OS/2. Instead, you can use the four slots to expand your system, adding to it, say, a network card and a scanner card, while still keeping two slots free for more additions. Unlike AT-class machines, which use 220-watt power supplies, the Deskpro 386S uses a 140-watt power supply, which should be adequate for powering up a fully configured machine.

The Deskpro 386S's system board, which houses a Toshiba hard disk controller, a Zylog floppy disk controller, and an Intel keyboard controller, also exemplifies thoughtful engineering and economy of design. The board uses surface-mount technology, which makes for efficient layout of components and aids in heat dissipation. All input/output functions are built into the system board, which can also play host to an optional 16-MHz Intel 80387SX coprocessor ($799).

From surface-mount technology to a modular means of expanding memory, the Compaq 386S uses many clever methods to save space but makes no sacrifices in the way of standard features. Its intelligent design, expandability, and good performance show that you don't have to trade functionality for desktop real estate.
—**Robbin Juris**

IBM CORP.

IBM PS/2 Model 70-E61 (16 MHz)
IBM PS/2 Model 70-121 (20 MHz)
IBM PS/2 Model 70-A21 (25 MHz)

IBM's most recent additions to the PS/2 product line bring 386 power to your desktop in a package small enough to leave you a lot of desk for other pursuits. In fact, the Model 70 lineup packs all this 386 power in a case the size of the Model 50—5½ by 14¼ by 16½ inches (HWD)—making the Model 70 one of the smallest of the small-footprint 386 machines reviewed here. And at 21 pounds, the Model 70 is lighter than some luggables.

PC MAGAZINE

"The Dataworld 286 [12MHz] AT compatible... [is]... the fastest machine of the nine tested in that review [July 1988]." (September 27, 1988).
and
... speed and excellent compatibility... hundreds of dollars less expensive than other AT compatible.

PC MAGAZINE EDITOR'S CHOICE

"Marvelously cheap, powerful alternative ... outperformed the other 286's ..." (October 11, 1988)

NOW! 20MHz 286 SI = 22.5



DATA-286 12MHz

80286 running at 8/12Mhz, 0/1 wait state
Phoenix BIOS std. (Award BIOS opt.)
512KB of RAM, expandable to 1MB on board
Socket for 80287-8, -10
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
Floppy/hard disk controller (1:1 interleave controllers available)
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

$1195



Portacomp II

80286 running at 8/12Mhz, 0/1 wait state
Phoenix BIOS std. (Award BIOS opt.)
512KB of RAM, expandable to 1MB on board
Socket for 80287-8, -10
Real-time clock with battery backup
1.44MB 3.5" floppy disk drive
20MB, 39ms, self-parking hard drive
102-key keyboard with "click"
Supertwist backlit LCD, 640x400 res.
RGB/monochrome output port
Weighs under 20 Lbs.
1.2MB external floppy drive opt.
Carrying case available

$1975



DATA-286 20MHz

80286 running at 10/20Mhz
AWARD BIOS std.
1MB of RAM, exp. to 2MB on board
EMS 4.0 support for memory over 1MB
Socket for 80287
200W power supply
Real-time clock with battery backup
1.2MB floppy disk drive
1:1 interleave floppy/hard disk controller
101-key keyboard with "click"
Mono card w/parallel port (720x348)
TTL monitor with tilt/swivel base

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COMPLETE 10MHz DESKTOP SYSTEMS FROM $945.00



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Front panel on/off switch
220W power supply
6 half-height drive bays
Dimensions: 16 3/4"(D) x 7 3/8"(W) x 25 5/8"(H)
Available for 286-/386- models



DATA-386

4.77/6/8/16MHz (20MHz opt.)
1MB of RAM, exp. to 10MB
Phoenix BIOS std. (Award opt.)
220W power supply
1.2MB floppy disk drive
Floppy/hard disk controller
101-key keyboard with "click"
Five 16 and two 8-bit slots
Mono card and monitor **$1995**



Portacomp I

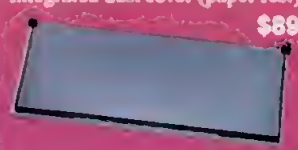
80286 8/12MHz, 0/1 wait
Phoenix BIOS std. (Award opt.)
512K RAM (exp. to 1MB)
200W power supply
1.2MB 5.25" floppy drive
20MB hard disk drive
Supertwist backlit LCD
RGB output port
5 expansion slots
1 parallel, 2 serial ports **$1875**



Dataworld Keyboard

101-key enhanced layout
L-shaped large return key
Integrated dust cover (paper rest)

$89





Color-coded key set for WordPerfect available

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There are three variations of the IBM PS/2 Model 70, each running at a different clock speed: the Model 70-A21, $11,295, races at 25 MHz; the Model 70-121, $7,995, runs at 20 MHz; and the Model 70-E61, $5,995, cruises along at 16 MHz. As you might expect, as the processor speed increases, so does the number of features.

The high-end Model 70-A21 is a marvel of clever engineering and design, starting with the two-tiered system board design—the key to packing so much power into such a small box. On the main system board, covering most of the bottom portion of the case (the 132-watt power supply takes up the remaining space), you'll find the Micro-Channel-architecture (MCA) circuitry which uses a 32-bit data path to move data along the bus. A VLSI chip handles the system's VGA graphics, three slots for expansion cards (one 16-bit with a video extension and two 32-bit), and a system clock powered by an extended-life lithium battery. Parallel, serial, and mouse ports are also found on the system board.

The PS/2 Model 70 packs 386 power in a case the size of a Model 50, making it one of the smallest 386 machines around. At 21 pounds, it's lighter than some luggables.

The Model 70-A21 ships with 2MB of 80-nanosecond dynamic RAM, and three empty 2MB SIMM sockets allow you to increase the system board RAM to 8MB. This system is capable of addressing 16MB RAM; while the IBM PS/2 Memory Expansion Option card will provide from 2MB to 8MB additional RAM, the board will take one of your 32-bit MCA slots.

The second-tier daughterboard contains the 25-MHz Intel 80386 processor, a socket for an optional 25-MHz 80387 coprocessor, and RAM cache consisting of 64K of 30-ns. static RAM managed by an Intel 82385 cache controller. Although the 82385 is equipped to handle only a 32K RAM cache, IBM's engineers have altered its operation to let it handle 64K to provide maximum performance.

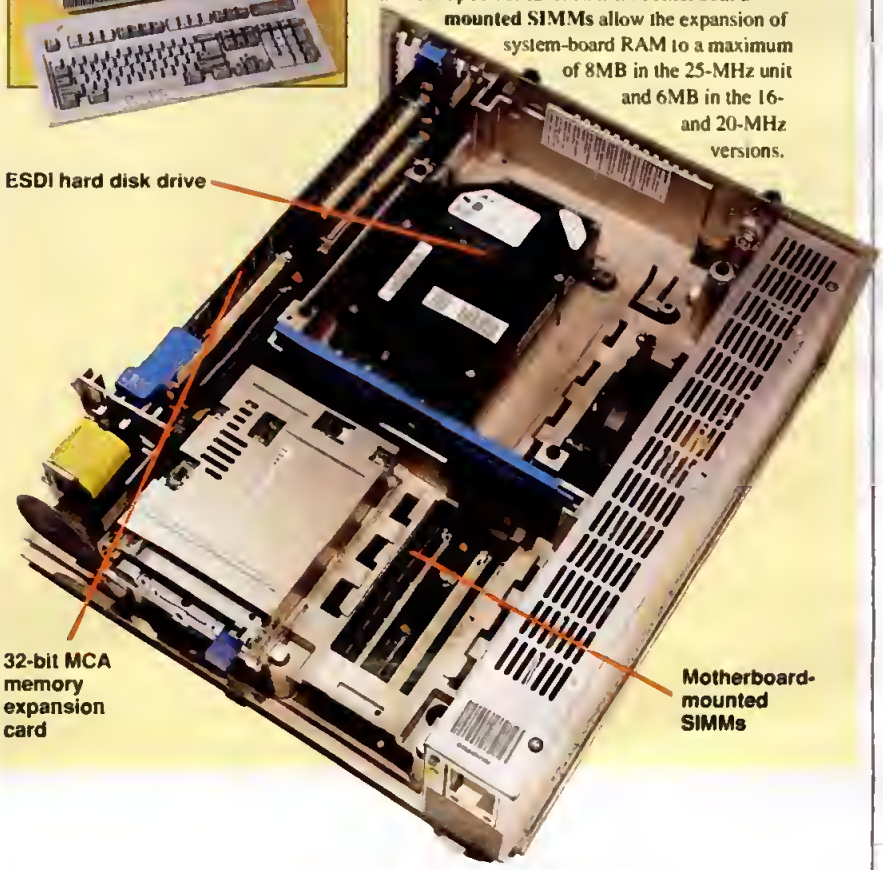
Both the midlevel Model 70-121 and the 16-MHz Model 70-E61 put all the system components on the system board; neither makes use of a daughterboard or cache memory. The Model 70-121's 20-MHz Intel 80386 chip and socket for an optional 20-MHz 80387 coprocessor are moved onto the system board, as is the case with the 70-E61's 16-MHz Intel 80386 and its 16-MHz 80387 socket. The other components of the system board are the same as those found on the Model 70-A21.

The 20-MHz 70-121 ships with 2MB of 85-ns. RAM on the system board, whereas the 16-MHz 70-E61 ships with 1MB of 100-ns. system board RAM. Both models are expandable to 6MB system board

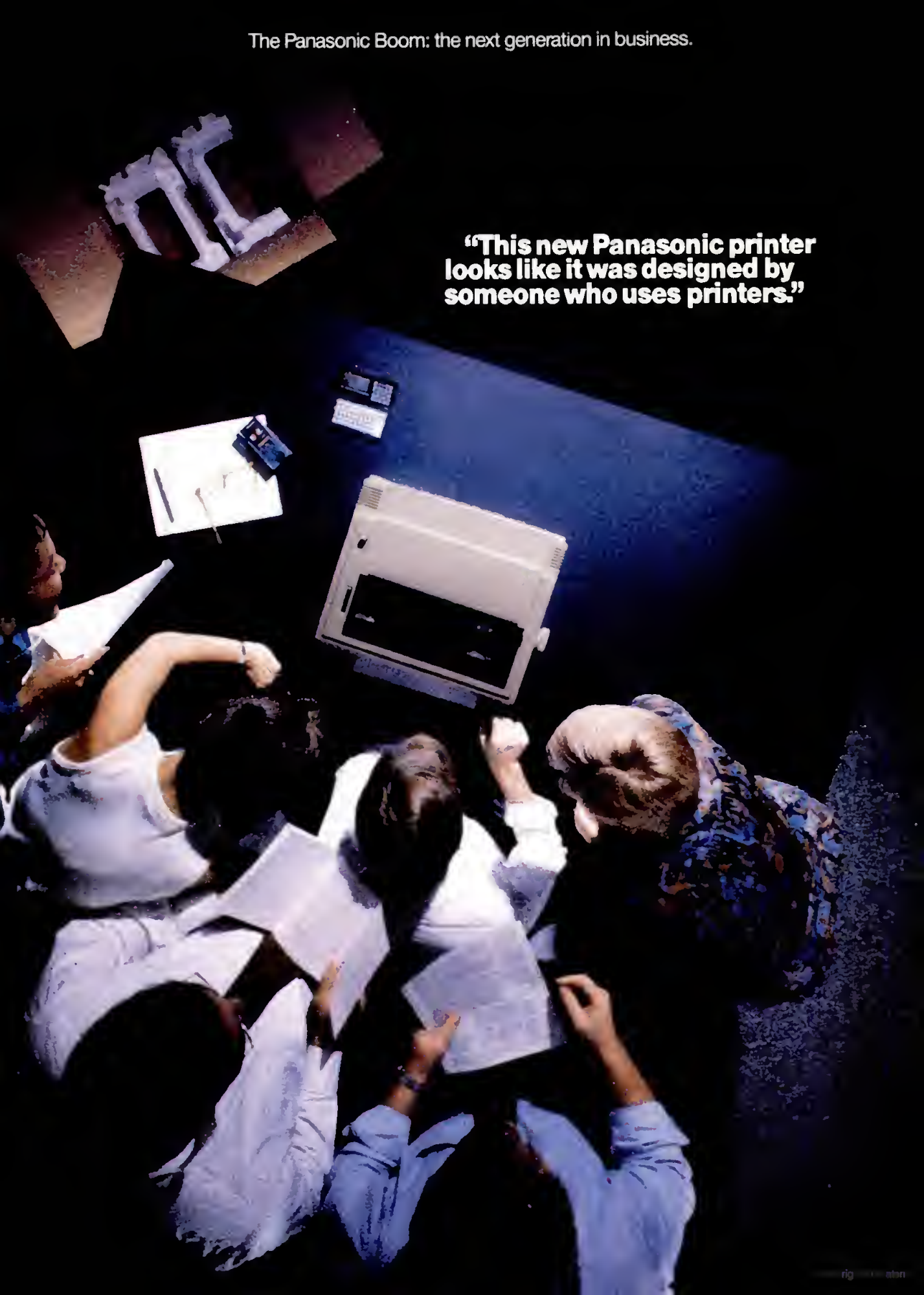


IBM PS/2 MODEL 70

IBM's PS/2 Model 70-E61, -121, and -A21 speed along at 16, 20, and 25 MHz, respectively; the 16-MHz unit shown supplies a 60MB hard disk, 1MB RAM, and a VGA monitor for $6,618. IBM uses **ESDI hard disk drive** controllers in all three versions of the PS/2 Model 70. Using a **32-bit MCA memory expansion card**, each version can address up to 16MB of RAM. **Motherboard-mounted SIMMs** allow the expansion of system-board RAM to a maximum of 8MB in the 25-MHz unit and 6MB in the 16- and 20-MHz versions.



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Introducing the Panasonic® 1124 24-Pin Printer. Designed by the people who'll use it.

Before we designed the 1124, we talked to customers to find out what features they wanted. And created a printer specially designed for non-software experts. The EZ Set™ Operator Panel allows you to make choices simply and quickly—without having to program any software. This printer puts you in command. And puts the commands at your fingertips.

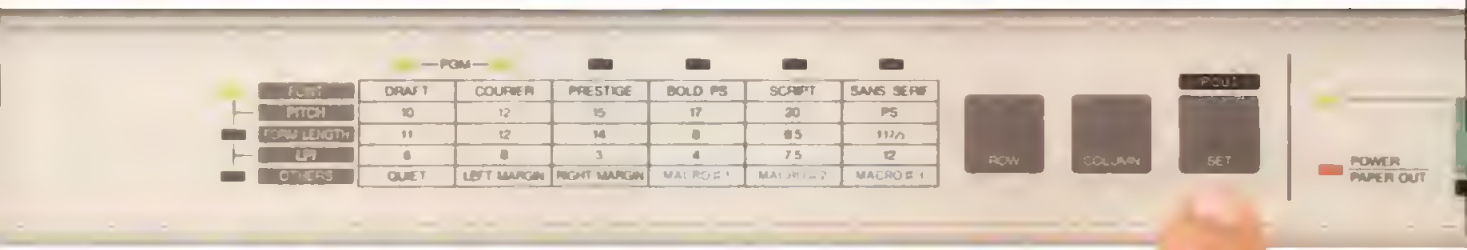
The ergonomically-designed EZ Set Operator Panel presents you with all the features you use most. There's even a special Macro feature that allows you to easily recall all the panel settings for three different formats at the press of a button.

Selectable on the EZ Set™ Operator Panel:

- Fonts: 1 Draft and 5 Letter quality
- Pitch: Choose from 6
- Form Length: From 8" to 14"
- Lines per Inch: 3, 4, 6, 7.5, 8, 12
- Margins: Left and right
- Quiet Mode: Cuts printer noise by 50%
- 3 Macros
- Function Mode
- Perforation Cut
- Forward and Reverse Micro Line Feeds
- Memo Load
- And more



The EZ Set™ Operator Panel puts over 20 features at your fingertips—not inside the cabinet.



Put the printer wherever it's most convenient. The 1124 accepts paper from either the rear, the bottom or the front.

Where you put the printer, and where you want the printer, can now be one and the same location. Whether you'll be using single sheets, continuous fanfold, or envelopes.

By flipping open the front panel, you can feed single sheets—either lengthwise or sideways—from the front. Most other printers require you to change your software program for sideways printing. And with an optional automatic cut sheet feeder, you can even feed single sheets through the top.

Fanfold paper can be fed from either the rear, the bottom or front of the machine. Without snaking over, under or around the cables. And a special *Perforation Cut* feature lets you tear off sheets at the perf, yet still begin the next sheet within 1/3" from the top—automatically.

When you're running fanfold—but need to print a single sheet or envelope in a hurry—the *Memo Load* feature lets you do it without removing or wasting the fanfold paper.

And *Micro Line Feed* lets you position your pre-printed forms just where you want them.



Only one paper path is available at any given time for continuous paper.



The 1124 lets you present your ideas with sharp letter quality and crisp, clear graphics.

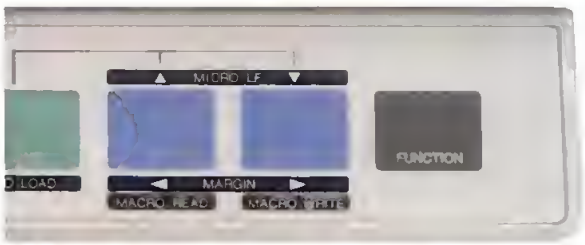
The 1124 gives you five letter quality fonts—standard.

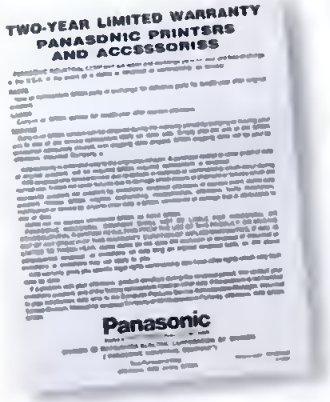
And two draft quality. And by combining the fonts, the character sizes and the enhancement modes you have 5500 valid type style combinations right at your fingertips.

And you can do even more. Because the 1124 uses 360 x360 dots per inch bit-mapped graphics to produce special printed effects—everything from company logos to line art and photo-like images.

Everything's sharp. Crisply defined. In both draft mode—at up to 192 characters per second—and letter quality mode—at up to 63 characters per second.

Draft Pica
Draft Elite
Courier Pica
Prestige Elite
Bold Proportional Space
Sans Serif Pica
Script Pica





Two of the 1124's best features, however, can't be found on the EZ Set™ Operator Panel: Terrific value. And a 2-year warranty.

The 1124 is a full-featured 24-pin printer. Compatible with the rich software libraries supporting the Epson® LQ-2500 and IBM® Proprinter™ X24.

But the 1124 features a 9-pin price.

Plus something you'll find on very few printers out there: a two-year warranty* on *both* parts and labor, from Panasonic.

That makes it a good investment. With excellent investment protection.

The Panasonic 1124 24-Pin Printer. In today's business environment, it's the printer that makes the most sense.

For more information on the 1124 or any of our other versatile, sophisticated printers, just call:

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This new "Push-Pull" tractor makes the 1124 incredibly simple to load.

It's not an ordinary tractor.

Or standard friction feed. And it's not a cumbersome add-on.

Instead, this new flexible design incorporates the best features of both feed types. Because it's adjustable, you can easily load paper from the front, bottom, or rear. In *Pull* mode, continuous fanfold paper feeds from the bottom or front. In *Push* mode, fanfold feeds from the rear.





In addition, *Push* mode allows you to tear continuous forms cleanly, without skipping a form just to advance to the next one.

And this new push/pull tractor and friction feed system makes it easier than ever to print non-standard paper sizes, like mailing labels, envelopes, multi-part forms, etc.

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The Panasonic 1124 24-pin printer.

Print Method:
Impact Serial Dot Matrix

Print Head and Life:
24 pin (0.2mm wire diameter)
100 million characters (draft)

Print Direction:
Bidirectional (user selectable Unidirectional)
Logic Seeking

Print Speed (Matrix):
(Characters per second):

	Draft	LQ
Elite—	192 cps	63 cps
Pica—	160 cps	53 cps

Letter Quality Fonts:
Courier, Prestige, Bold PS, Script, Sans Serif

LQ Character Cell Matrix:
24x30

Printing Sizes:
5, 6, 7.5, 8.5, 10, 12, 17, & 20 characters per inch

Characters Per Line:
40, 48, 60, 68, 80, 96, 120, 137 & 160 characters per inch

Character Sets:
96 ASCII characters; 96 Italic ASCII characters
32 Regular and 32 Italic International characters
International characters—13 countries.
159 IBM Special characters—Sets 1 & 2

Bit Image (matrix):
360 x 360 dots per inch

EZ Set™ Operator Panel:
Controls over 20 functions including:

Font	Lines Per Inch
Pitch	Quiet Mode
Form Length	Perforation Cut
Paper Loading	Paper Parking
Macro Settings	Margin Settings
Micro Line Feed	Default Setting

Line Feed Time:
Approx. 100 msec (with 1/6-inch line feeding)

Tractor Feed:
User selectable push or pull, swivel mount, flat belt

Paper Feed:

Path	Method
Front	Friction or Pull Tractor
Rear	Push Tractor (adjustable)
Bottom	Pull Tractor (adjustable)
Top	Cut Sheet Feeder (optional)

Paper Specifications:

Continuous:	4.0 to 10.0 inches, 14 to 24 lbs.
Single Sheet:	4.0 to 11.7 inches, 14 to 24 lbs.
Envelopes:	#10
Copies:	Original and 3 non-carbon copies
Thickness:	Maximum thickness less than 0.013 inches

Emulations:
Epson* LQ-2500, IBM* Proprinter™ X24

Interface:
Centronics parallel, RS-232C serial (optional)

Buffer:
6K (standard); additional 32K (optional)

Noise Level (LQ mode):
56 dBA (standard mode), 53 dBA (quiet mode)

Environment:

Operating:	50° F to 95° F at 30 to 80% humidity
Storage:	−4° F to 140° F at 10 to 90% humidity

Reliability:
4,000 hours MTBF

Warranty:
Limited 2 Years—Parts and Labor

Dimensions and Weight:
16.9(w) x 14.1(d) x 5.6(h) inches; 18.7 lbs.

Options:
Automatic Single Bin Cut Sheet Feeder (KX-P36)
RS-232C with Current Loop Serial Interface (KX-P19)
32K Expansion Buffer Chip (KX-P43)

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Panasonic
Office Automation

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

IBM PS/2 Model 70-E61 (16 MHz)
IBM PS/2 Model 70-121 (20 MHz)
▶**IBM PS/2 Model 70-A21** (25 MHz)
IBM Corp.
Contact your nearest authorized IBM dealer.
(800) IBM-2468
List Price: Model 70-E61, with 1MB RAM, 1.44MB 3½-inch floppy disk drive, 60MB hard disk, $5,995; Model 70-121, with 2MB RAM, 1.44MB 3½-inch floppy disk drive, 120MB hard disk, $7,995; Model 70-A21, with 2MB RAM, 1.44MB 3½-inch floppy disk drive, 120MB hard disk, $11,295; 1MB Memory Module (85 ns.), $695; 2MB Memory Module (85 ns.), $1,395; 2MB Memory Module (80 ns.), $1,495; 8512 VGA monitor (no card needed; basic configuration supports VGA), $623; 80387 coprocessor, $2,395; 150MB tape drive, $2,095.
In Short: Each member of IBM's PS/2 Model 70 trio delivers top performance, tiny footprint, and light weight for a premium price. The real stunner of the bunch is the 25-MHz Model 70-A21, the second-fastest computer ever tested by PC Labs. The 25-MHz machine has a two-tiered motherboard system not implemented by its 20- and 16-MHz siblings; they also lack the 25-MHz machine's cache memory. The main drawback of these Micro Channel machines is their limited expansion possibilities; all three have just three expansion slots.
CIRCLE 682 ON READER SERVICE CARD

RAM and have three SIMM sockets that can hold either 1MB or 2MB 85-ns. chips. To improve performance, these machines make use of interleaved memory that allows for operation between zero and two wait states. (For a discussion on different memory architectures, see the sidebar "Working at the Speed of RAM.")

There's 128K ROM divided among system BIOS support—the Advanced Basic Input/Output System (ABIOS) a BASIC language interpreter and a power-on auto-sense feature that identifies the hardware present in the system and adjusts the setup RAM accordingly. The auto-sense feature is supported by the MCA found in Models 50, 60, and 80 as well.

Each of the three machines has a snap-in plastic tray that fits over the top of the system board, between the power supply and the three expansion slots. This tray contains the 3½-inch 1.44MB microfloppy drive and the hard disk; there is also a bay for an additional microfloppy drive.

IMPROVED HARD DRIVES Both the Model 70-A21 and the Model 70-121 ship with a 120MB hard drive rated at 23 milliseconds with a 10.2 megabit-per-second data-transfer rate, while the Model 70-E61 ships with a 60MB drive rated at 27 milliseconds with an 8.4 megabit-per-second data-transfer rate. These drives are a big improvement over the infamous drives included with the Model 50. For one thing, they are of a reasonable size, although 120MB may still not be large enough for some users. For another, they have an ESDI (Enhanced Small Device Interface) controller built right into the drive. ESDI improves hard disk performance by moving data from the bus to the drive twice as fast as the older ST-506 standard. The hard drive is connected to the system board through a bus extension.

IBM doesn't provide a monitor with the system. The Model 70, as is the case with the rest of the PS/2 family of computers, requires an analog VGA monitor. With an adapter, the PS/2 can also use a multiscanning monitor.

The greatest shortcoming of the Model 70 is the lack of expansion slots. With only three slots available, you won't be able to turn your Model 70 into the ultimate power machine. And there are still few expansion cards that will work with the MCA bus. Since so many features and ports are included on the system board, three slots could satisfy many users. Even so, the Model 70 is plagued by a basic lack of expandability. And the 60MB or even 120MB hard disk may not be large enough for some of the memory-intensive applications like CAD, CAE, or multiuser applications, for which you would want to purchase a powerful 386 in the first place.

So just how does the Model 70's performance on PC Labs benchmark tests stack up with the competition? Among the small-footprint 386 PCs reviewed in this article, the 25-MHz 70-A21 took top honors in the PC Labs 80386 Instruction Mix benchmark test, with a time of 2.25 seconds. In fact, the only machine we've tested in PC Labs that is faster than the Model 70-A21 in our 80386 Instruction Mix benchmark test is the ALR FlexCache 25386—a less-expensive, floor-standing model.

However, the 20-MHz 70-121, at 3.24 seconds, is slower than both the Arche Rival 386, at 3.20 seconds and the Normerel ATC-386, at 3.15 seconds. Both of these computers run at 20 MHz. But all three IBM machines, particularly the Model 70-A21, do quite well when tested for extended memory performance.

The ATC-386 by Normerel is a reasonably priced top-performance PC from France with design savoir faire.

Because PS/2s are manufactured in an exceptionally automated factory, they can be designed with smaller footprints. For example, IBM uses surface-mount soldering to attach the chips to the system board. In standard mount technology, the pins of the chips are fit through the system board manually. Since the chips are placed on the board by a machine, surface-mount technology allows the chips to be placed closer to one another.

Despite some real shortcomings—high price, lack of expansion slots, and relatively small (and limited) disk size—the Model 70's elegant design makes it a machine you would love to love. And the 25-MHz Model 70-A21 may be considered the most attractive PS/2 offering yet. With all this power and performance packed into such a small case, the Model 70 just might be the PS/2 to convince you to make the Micro Channel leap.
—Catherine D. Miller

NORMEREL U.S.A. INC.

Normerel ATC-386

Hong Kong, Taiwan, and Malaysia are familiar place names on chip sets and shipping boxes. But how about a computer from *France* with a DOS manual sporting

Will everyone who hates making backups please raise their hand.



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Unless you have an Irwin® mini-cartridge tape backup system.

In which case you don't think about eternity. You think about what's for dinner and how you just might beat the rush hour.



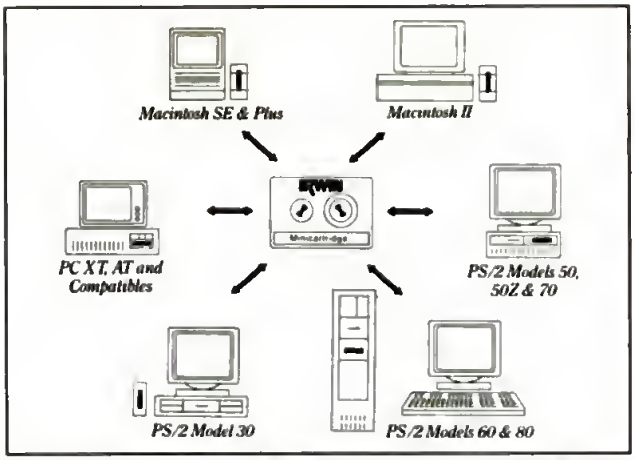
Because our EzTape® software lets you automatically store exactly the data you want, whenever you want.

Without the hassle of complicated commands or complex procedures.

So instead of heading for a case of floppies at day's end, you can head for home.

Irwin tape drives work with all the popular networks.

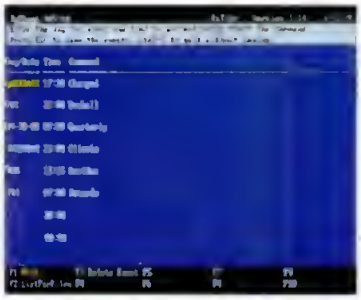




With an Irwin minicartridge system you can easily share data around the whole office. Even among different kinds of computing systems.

And backup tapes written on one Irwin drive will be read perfectly by a similar or higher capacity Irwin model.

With our patented AccuTrak™ precision tracking technology, you can transfer data from a PC to a PS/2 to a Mac. And vice versa.



EzStart™ gives you set-and-forget programming. Up to 64MB of automatic backup every evening, every weekend — whenever you want.

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CIRCLE 219 ON READER SERVICE CARD

Small-Footprint 386 PCs: Summary of Features

(Products listed in ascending price order)

The following definitions explain the terms and analyze the aspects represented in this table of features. The phrases are listed in the same order as in the left-hand column of the table.

Basic configuration Because hardware vendors frequently offer a choice among various hard disk drives and monitors—at different prices—we are reporting the price of a completely stripped-down model as a "basic" configuration. Note that all seven computers in this roundup are equipped with IBM Enhanced–style keyboards, which is why the question of keyboard design does not appear in the table.

Software included Hardware manufacturers may or may not bundle software with their computers. Bundled software may include DOS, disk caching programs, setup and install programs, and various utilities. DOS is often available only at an additional cost.

Reset switch Many computers now come with a reset switch allowing a cold reboot of the computer. This switch saves wear and tear on the power switch.

Bus clock speeds (MHz) Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 or 10 MHz. Time-out periods, sometimes called wait states, are often used to slow down the bus. (See the sidebar "Working at the Speed of RAM.")

Disk controller manufacturer/type Several interfaces are used to control the way data is transferred from the hard disk to the computer. The most common disk interface standard is the ST-506/412, used in the IBM PC-XT and PC AT. Two other common data transfer interfaces are SCSI (Small Computer System Interface) and ESDI (Enhanced Small Device Interface). Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers.

BIOS version and date The BIOS date is also important to those planning to use 3½-inch disk drives. Earlier BIOS versions cannot handle this format.

Chip packaging Memory chips may be soldered or socketed in place, and they use one of two styles of packaging: SIMM (Single In-line Memory Modules) or DIP (Dual In-line Package). With socketed chips, problem chips can be removed and new chips placed into their sockets. If a soldered chip goes bad, the entire board must be replaced.

SIMM technology involves soldering RAM chips onto a small board, which is then installed on an expansion board or directly on the system board. Easy installation in minimal space has made this a popular method of expanding RAM. DIP technology was widely implemented on older boards. The newest technique uses surface-mount technology, whereby chips are soldered directly to the surface of the board rather than to holes drilled into the board.

RAM chips RAM chips come in two basic types: static and dynamic. Static RAM chips (SRAMs) are faster and more efficient but costlier. Dynamic RAM chips (DRAMs) cost less and are more common, but the trade-off is in slower processing and operation.

Interleaved memory CPU speed is usually faster than memory speed. Interleaved memory increases processing speed by splitting the memory into two or more portions. The CPU then sends information to a section at a time, allowing one section to process while another receives data.

Shadow RAM Shadow RAM is a technology that loads system BIOS or video BIOS directly into fast RAM on bootup of the computer. The BIOS then operates much faster.

Type of cache controller Using a cache controller chip is one method of increasing computer speed via caching. Intel's 82385 Cache Memory Controller is an example of a static RAM cache. (See "Working at the Speed of RAM." Additional background may be found in the sidebar "What Is Caching Anyway?" *PC Magazine*, June 28, 1988, page 98.)

Maximum 32-bit RAM There is currently no standard for 32-bit cards, and not many cards are available today. Many computer manufacturers, however, have designed their own 32-bit memory expansion cards. 32-bit slots for memory cards are especially important in the era of OS/2, a memory-hungry operating system.

FCC certification class Two classes of FCC (Federal Communications Committee) approval may be given to computers: Class A and Class B. These classes concern levels of radio-frequency interference. With Class A approval, a computer may be operated in a business locale. The tougher Class B rating allows home use as well, where computers are likely to be placed near radios and television sets. Certification tests must be performed by private testing companies. The passing results are then sent to the FCC for final certification, a process taking several months or more.

Basic configuration

- List price
- Dimensions (HWD, inches)
- RAM

- Floppy disk drives

- Hard disk drive
- Drive bays

- Software included

- OS/2 supplied

- Monitor
- Ports

- Slots

- 32-bit bus type

- Power supply (watts)
- Reset switch

Configuration tested

- List price
- Upgrades and additions to the basic configuration

- Microprocessor clock speeds
- Wait states

- Bus clock speeds

- Disk controller manufacturer and type

- System drive capacity

- BIOS version and date

- System board manufacturer

- 386 chip set manufacturer
- Memory chip type
- Chip packaging

Memory specifications

- RAM chips
- Interleaved memory
- Shadow RAM

- Type of cache controller
- Cache software
- Maximum RAM on motherboard

- Maximum 32-bit RAM
- Math coprocessors supported

Other

- Warranty
- FCC certification class

Normerel ATC-386	Compaq Deskpro 386S	Amdek System/386	Arche Rivel 386	IBM PS/2 Model 70-E61	IBM PS/2 Model 70-121	PC IBM PS/2 Model 70-A21
$3,795	$3,799	$3,850	$4,395	$5,995	$7,995	$11,295
3.8 × 15.9 × 15.3	5.9 × 15.8 × 14.8	8.3 × 15 × 17	6 × 17 × 16.5	5.5 × 14.3 × 16.5	5.5 × 14.3 × 18.5	5.5 × 14.3 × 16.5
2MB	1MB	1MB	2MB	1MB	2MB	2MB
One 1.44MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.44MB	One 1.44MB	One 1.44MB
3½-inch	5¼-inch	5¼-inch	5¼-inch	3½-inch	3½-inch	3½-inch
None	None	None	None	60MB	120MB	120MB
Two half-height	Two one-third-height, one half-height	Three half-height	Three half-height	Two 3½-inch half-height, one full-height	Two 3½-inch half-height, one full-height	Two 3½-inch half-height, one full-height
DOS 3.3, diagnostics, setup, disk cache	CEMM, disk cache	DOS 3.2, GW-BASIC, utilities, diagnostics, disk cache	DOS 3.3, GW-BASIC, setup	Setup, diagnostics, disk cache	Setup, diagnostics, disk cache	Setup, diagnostics, disk cache
○	Optional ($325)	Optional ($325)	○	Optional ($325 standard edition, $795 extended edition)	Optional ($325 standard edition, $795 extended edition)	Optional ($325 standard edition, $795 extended edition)
None	None	None	Amber monochrome	None	None	None
3 serial, 1 parallel, 1 floppy disk, 2 video	1 serial, 1 parallel, 1 auxiliary	2 serial, 1 parallel	2 serial, 2 parallel	1 serial, 1 parallel, 1 mouse	1 serial, 1 parallel, 1 mouse	1 serial, 1 parallel, 1 mouse
Two 16-bit, one 8-bit	Four 16-bit	Six 16-bit, two 8-bit	Two 32-bit, four 16-bit, two 8-bit	Two 32-bit, one 16-bit (all MCA)	Two 32-bit, one 16-bit (all MCA)	Two 32-bit, one 16-bit (all MCA)
N/A	Compaq	Wyse Technologies	Proprietary	MCA	MCA	MCA
100	140	190	200	132	132	132
●	○	●	●	●	●	●
$4,595	$9,740	$6,020	$5,190	$6,618	$8,618	$11,918
40MB hard disk, VGA monochrome monitor	40MB hard disk and 40MB backup tape, VGA monitor, 16-MHz 80387SX coprocessor, 4MB memory module	40MB hard disk, VGA card and monitor	40MB hard disk	Analog VGA monitor	Analog VGA monitor	Analog VGA monitor
20 MHz	16 MHz	16 MHz	10/20 MHz	16 MHz	20 MHz	25 MHz
0	0	0 at 16 MHz; 1 at 8 MHz	0	0 to 2	0 to 2	0
20 MHz	16 MHz	8/16 MHz	10 MHz	16 MHz	20 MHz	25 MHz
Western Digital (SCSI)	Compaq (proprietary)	Western Digital (ST-506)	Arche (ST-506)	IBM (ESDI)	IBM (ESDI)	IBM (ESDI)
Motherboard handles 2 floppy disk drives or 1 floppy and 1 hard disk drive	Controller card handles 2 floppy and 2 hard disk drives and 1 tape drive	Controller card handles 2 floppy and 1 hard disk drive or 1 floppy and 2 hard disk drives	Controller card handles 2 floppy and 1 hard disk drive or 1 floppy and 2 hard disk drives	Motherboard handles 2 floppy and 1 hard disk drive	Motherboard handles 2 floppy and 1 hard disk drive	Motherboard handles 2 floppy and 1 hard disk drive
Normerel, Version 2.04 (July 1988)	Compaq ROM BIOS, Version F2M 03 (June 1988)	Phoenix ROM BIOS, Wyse Version 3.52 (September 1987)	Phoenix ROM BIOS Plus, Version 1.1002 (January 1988)	Advanced BIOS (April 1988)	Advanced BIOS (April 1988)	Advanced BIOS (April 1988)
Normerel	Compaq	Wyse Technologies	Arche	IBM	IBM	IBM
Chips & Technology	Intel	Tseng Laboratories	Chips & Technology	Intel	Intel	Intel
256K	1MB	256K	256K	1MB, 2MB	1MB, 2MB	2MB
SIMM	Surface mount	DIP	DIP	SIMM	SIMM	SIMM
DRAM	DRAM	SRAM	DRAM	DRAM	DRAM	DRAM
●	●	●	●	●	●	○
○	○	○	●	○	○	○
N/A	N/A	N/A	N/A	N/A	N/A	Intel (82385)
●	●	●	○	●	●	●
8MB	N/A	2MB	N/A	6MB	6MB	8MB
8MB	13MB	6MB	18MB	16MB	16MB	16MB
80287 or 80387	80387	80287 or 80387	80287 or 80387	80387	80387	80387
1 year	1 year	1 year	2 years	1 year	1 year	1 year
A	B	B	A	B	B	B

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; product does not have this feature.



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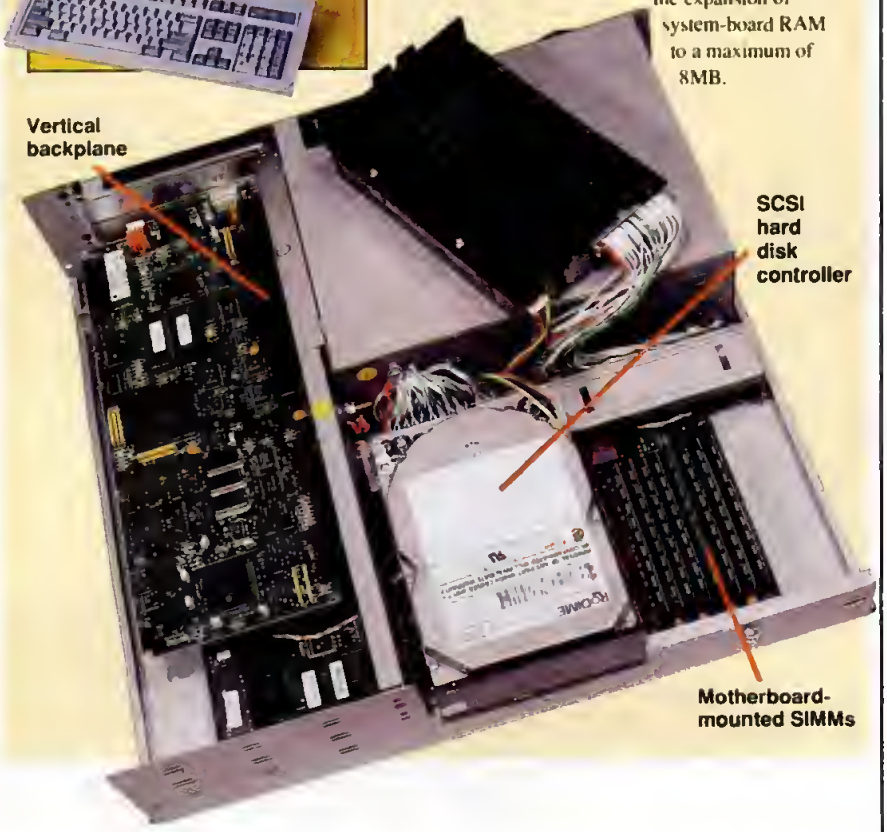
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CIRCLE 124 ON READER SERVICE CARD



NORMEREL ATC-386

The thin-as-a-textbook Normerel ATC-386 is a top-performing 20-MHz computer with a 40MB hard disk, 2MB RAM, and a VGA monochrome monitor for $4,595. Normerel's **vertical backplane** expansion-slot construction allows the horizontal mounting of expansion boards. Normerel is the only company in this roundup to use an **SCSI hard disk controller**. **Motherboard-mounted SIMMs** allow the expansion of system-board RAM to a maximum of 8MB.



PC MAGAZINE FACT FILE

Normerel ATC-386
Normerel U.S.A. Inc.
1309 44th St.
Orlando, FL 32809
(800) 327-9877
(407) 843-5224
List Price: With 2MB RAM, 1.44MB 3½-inch floppy disk drive, $3,795; with 40MB hard disk, $4,395; with 70MB hard disk, $4,595. VGA monochrome monitor, $200. VGA color monitor, $595. 80387 coprocessor, $735.
In Short: A speedy, elegant 20-MHz 386 with a slender CPU design. Slightly built, this French-made computer sacrifices some functionality in favor of design. The Normerel ATC-386 lacks a 32-bit bus and provides only three expansion slots. You're also limited to one floppy disk drive; a second floppy can be added internally only at the expense of the hard disk.

CIRCLE 681 ON READER SERVICE CARD

a pink-and-black logo? The ATC-386 by Normerel is a reasonably priced top-performance PC with design savoir faire. Of the 386-based PCs clocking in at 20 MHz, this French number bears a closer look.

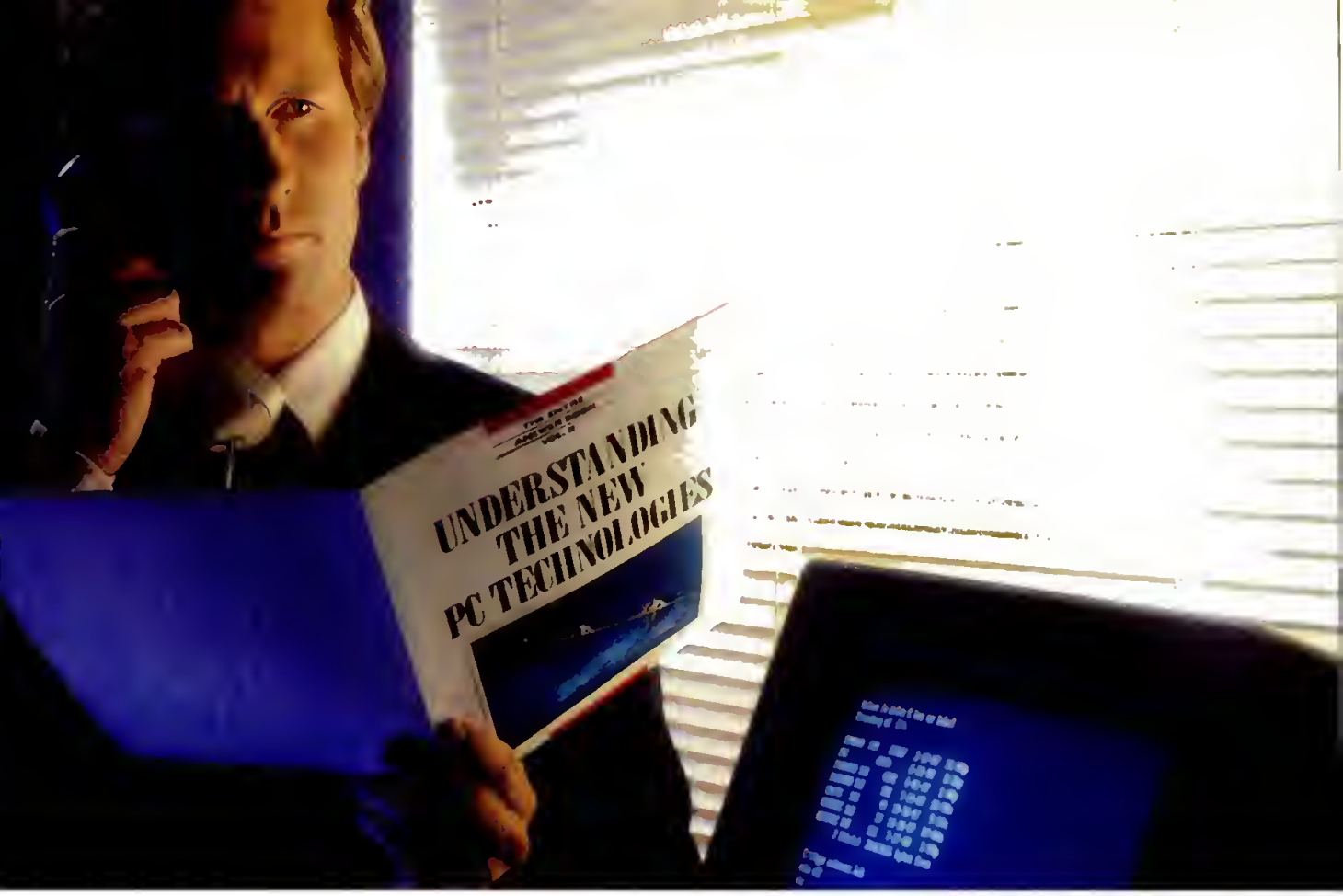
Down to the smallest detail, this machine has raised "making more out of less" to a high art. The CPU is the most compact of the machines reviewed here. At 3.8 inches high, it is about the height of a standard keyboard drawer or the size of a briefcase. Small design is grandly implemented in the Normerel ATC-386. Its three slots accept full-size AT cards and can be filled with 3270 boards, LAN cards or a CD ROM Interface. The machine tested well for throughput, is comfortable to use, and conserves power and space. Priced at $4,595 for a 40MB system unit with VGA monochrome monitor, its debut in America may be worth applause.

Something that looks this good on the outside has to be well built. Innovations in motherboard design, combined with SCSI technology, lie underneath the ATC-386's elegant and ergonomic external cover. A SCSI interface is strategically employed for its low-power-consumption and high-performance properties.

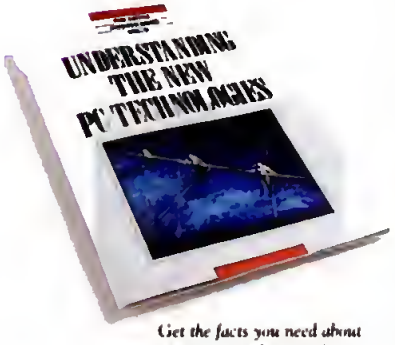
The evaluation unit was configured with a 40MB hard disk drive, a 3½-inch 1.44MB diskette drive, and 2MB of SIMM memory, expandable to 8MB. The motherboard is impressive. It has everything you might want except for the VGA adapter: three serial ports, one parallel port, a mouse port, space for a math coprocessor, and three slots for add-in boards. There are one 8-bit and two 16-bit expansion slots. At present, the 8-bit slot is occupied by Normerel's own VGA board, which incorporates the Paradise chip set. By the end of the year, VGA capability will be integrated on the motherboard, bringing the expansion slot count up to three. The system board supports either an 80287 or an 80387 math coprocessor.

For those who prefer a standard hard disk to SCSI minidrives, the proprietary Normerel BIOS will support an ST-506 drive. The base unit ships with DOS 3.3, a diagnostic diskette, and setup utilities including a 386 options kit. The options kit allows you to set the speed going out over each of the internal buses and interleaves base memory with zero wait states. The ability to adjust the bus speed is a good hedge against possible board incompatibilities.

Compatibility with IBM's vision of the future has become de rigueur for those



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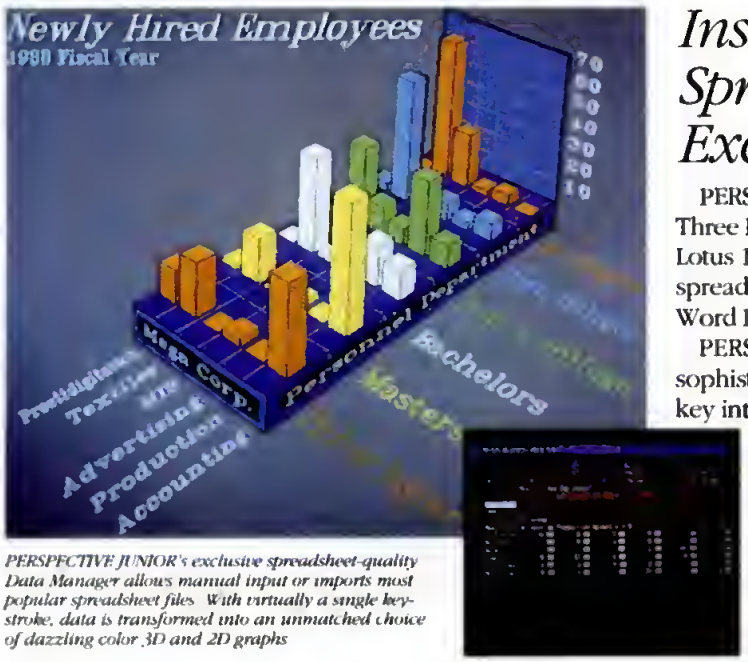
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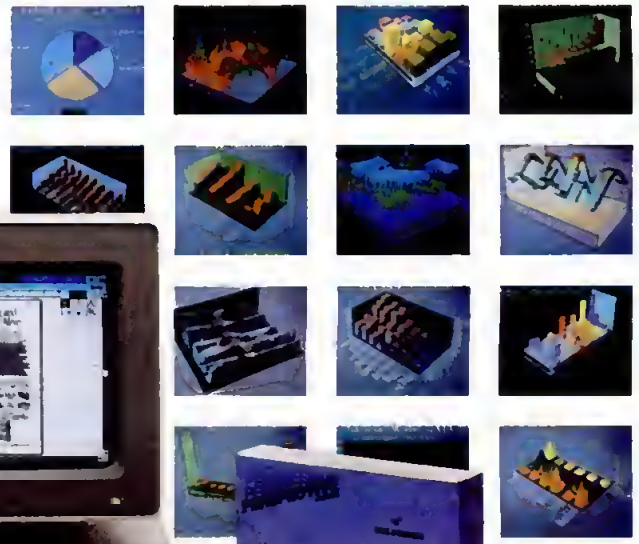
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CIRCLE 534 ON READER SERVICE CARD

PC EDITOR'S CHOICE

- **IBM PS/2 Model 70-A21 (25 MHz)**

Who could refuse the fastest computer IBM has ever built, housed in a box no wider than a monitor? If you've got the extra bucks to spend for performance, the 25-MHz IBM PS/2 Model 70-A21 is the second-fastest machine we've ever tested; only the floor-standing ALR Flex-Cache 25386 is faster. Our Editor's Choice applies only to the 25-MHz Model 70; the 16- and 20-MHz versions lack the sophisticated engineering that helps to justify the price of the 25-MHz computer. The 25-MHz Model 70 isn't without drawbacks, however: a near-$12,000 price tag (with 120MB hard disk, 2MB RAM, and VGA monitor), and just three expansion slots.

Of the 16- and 20-MHz group, two computers—both 16-MHz models—deserve honorable mention. The Amdek System/386 is an inexpensive, cleanly designed box with four free expansion slots and a high-quality (if somewhat slow) VGA monitor. By using the 386SX chip, the Compaq Deskpro 386S can offer 16-MHz 386 speed and Compaq quality for only about $400 more than a similarly equipped Compaq Deskpro 286/12. The SX chip is a 386 chip—with the exception that its memory access is only 16 bits wide, the same as in an AT. Compaq's fast VGA is on the motherboard, and a proprietary expansion slot lets you boost RAM to 13MB, leaving the four 16-bit expansion slots free for options.

The small-footprint 386 market, unlike the 286 market, is a still-evolving category; most of the major players haven't introduced their offerings. But your options aren't as limited as they seem. If your needs can be met by a 386 luggable, there are four streamlined, high-performing portables to choose from (see "Take It or Leave It: Portables with Desktop Power," PC Magazine, October 11, 1988).

who would compete in the American marketplace. Normerel has its own version of OS/2 with SCSI drivers, which the company expects to be available by year's end.

SPEEDIEST 20-MHZ "Can it perform?" is the real question. On the 80386 Instruction Mix benchmark test the ATC-386 was outperformed only by the IBM Model 70 running at 25 MHz. In other tests the ATC-386 consistently placed near the top of the group.

If 70MB of hard disk storage isn't enough for you, larger disk sizes are available, as is an external tape drive with 60MB cartridges for backup. There is no 32-bit slot in the Normerel ATC-386, but because the motherboard can accommodate 8MB of RAM, you may find that you can live without the faster slot.

Also missing is the extra floppy disk drive. The present configuration will support two floppy disk drives only at the expense of the fixed drive. Nor will the ATC-386 support more than one fixed drive internally. The low height of the CPU would have to be compromised quite a bit in order to fit a second floppy disk drive into this machine.

The Normerel ATC-386 is petite, powerful, and unique, delivering good functionality in a compact unit for a reasonable price. Normerel is the Original Equipment Manufacturer for Memorex/Telex in the United States, and it plans to distribute through value-added resellers and directly to Fortune 1000 companies. Well-styled and easy on the pocketbook, this machine may find its way into many a front office.—**Priscilla Tate-Austin** PC

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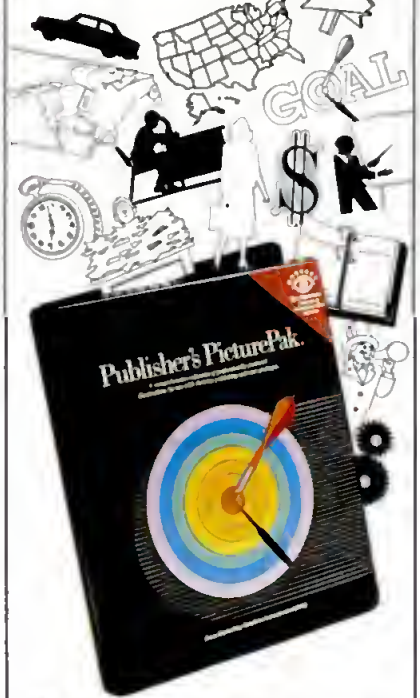
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CIRCLE 306 ON READER SERVICE CARD

IBM PC & Compatibles; Tandy 1000 & 3000 Computer Users

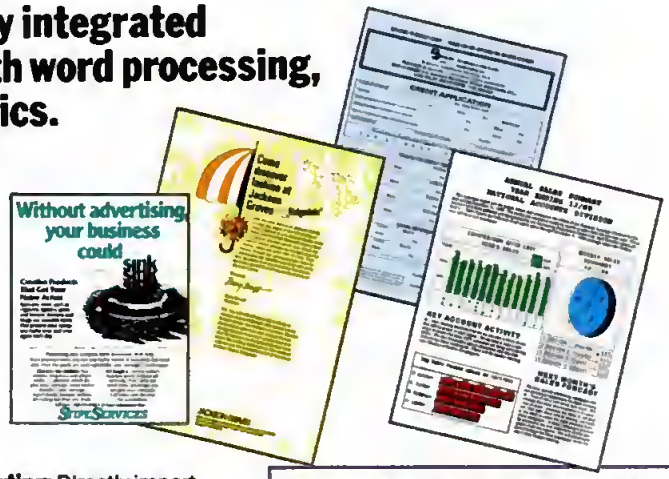
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CIRCLE 248 ON READER SERVICE CARD

BATTLE OF THE SPREADSHEET STARS

Four major spreadsheet players take aim not only at the current market leader—1-2-3, Release 2.1—but at an opponent that's not yet there—1-2-3, Release 3.0



Photograph: Marc David Cohen

Welcome to the new prime-time soap opera "Steamy Spreadsheets." Shiver with excitement as your favorite software companies sue each other, buy each other, gloat over each other's failures, and even face accusations of insider trading—all while locked in a bitter struggle for market dominance.

It's been a dizzy time. For us folks who only wanted a better spreadsheet, the commotion may seem irrelevant, but it's not. Besides the entertainment they provide, these carryings-on will influence what the next spreadsheet you buy looks like. As usual, Lotus Development Corp. is at the heart of the fray and, as always, you have to decide whether to stick to the familiar terrain of *Lotus 1-2-3* or to cover new ground. All the shouting doesn't make your choice any easier.

On the surface, the facts are well established. In the spring of 1987, Lotus announced that it would have Release 3.0 of *1-2-3* ready by about April of 1988. In the meantime, quite a few companies have

launched products better than the version of *1-2-3* now being sold, Release 2.01.

These companies weren't all tiddlers, either. Microsoft brought out a souped-up, PC version of its very successful Macintosh spreadsheet, *Microsoft Excel*, and Borland International put a lot of marketing muscle into *Quattro*, its *1-2-3* compatible. PCSG introduced *Lucid 3-D*, an innovative 3-D spreadsheet, and Surpass Software Systems weighed in with *Surpass*, which I think is the best *1-2-3* compatible ever sold. Computer Associates International, now a bigger software house than either Microsoft or Lotus, continued to beef up its already powerful veteran, *SuperCalc*, and Paperback Software International released a new and improved *VP-Planner Plus*, Version 2.0.

For those who want multidimensional spreadsheets, Sinper Corp.'s *TM/1*, our 3-D Editor's Choice last time we looked at spreadsheets (see "Analyzing Data from All the Angles," *PC Magazine*, October 27, 1987), is very capable, if offbeat. And *Silk*, the *1-2-3* competitor of choice last time (see "Challenging *1-2-3* on Price and Power," *PC Magazine*, October 27, 1987), has resurfaced after disappearing from the public eye for many months. During its period of silence, Daybreak Technologies maintained limited R&D and is now offering a new version of the product. (*Silk*, Version 1.1, is available from Daybreak Technologies Inc., P.O. Box 5629, 21213B Hawthorne Blvd., Torrance, CA 90509; (213) 542-5888.)

While the computer press licked its chops over this software feast, what did the users do? They kept on buying good old *1-2-3*. "Yeah, *Excel* and *Quattro* are interesting," they said, "but we'll wait and see what Release 3.0 looks like." The fireworks began last March when Lotus announced that Release 3.0 was going to be at least 6 months late. This delay was a priceless gift to the latest batch of *1-2-3* competitors, and some of them couldn't restrain themselves. Borland, which has missed plenty of well-advertised deadlines, gloated over Lotus's delays and started blasting them in advertisements.

ROUGH SPOTS AT LOTUS Lotus hit another bad patch when the public learned that only a month before the announcement of the Release 3.0 delay, many of its top executives had sold big chunks of Lotus stock. "Pure coincidence," said the company. "They didn't even know there was going to be a delay." The SEC didn't buy that story and is investigating what looks a lot like insider trading. How could Lotus execs not know that their main money-maker was behind schedule?

> ■ In the face of new, competitively priced spreadsheets, who would buy *1-2-3*?

And how did users react to all *this*? They kept buying good old *1-2-3*.

True, *Quattro* made it into *PC Magazine*'s list of top-ten sellers, but *1-2-3* remains the best-selling spreadsheet. *1-2-3* users like what they know and know what they like.

But if half of what *1-2-3*'s competitors say about their products is true, aren't there real alternatives? In this article, we try to answer that question by reviewing four spreadsheets that we think are serious contenders to replace *1-2-3* in America's offices today: *Microsoft Excel*, *Surpass*, *Quattro*, and *VP-Planner Plus*. Since standards are standards and we deviate at our peril, I should mention that all but *Excel* are *1-2-3* compatible (although *Excel* does read and write the *1-2-3* .WKS and .WK1 file formats). Of the non-*1-2-3*-compatible spreadsheets available today, only *Excel* has, in our view, a chance at establishing a new standard.

With any short list, there are debatable inclusions and exclusions. *SuperCalc*, always excellent, isn't here only because the new release, *SuperCalc5*, isn't ready (see the sidebar "What 1-2-3 Release 3.0 and SuperCalc 5.0 Promise"). *Lucid 3-D* (see the sidebar "Lucid 3-D: Picking Up the Add-in Leads"), though a fine, innovative product, is too far off the *1-2-3* standard to cause wholesale defections. And although some consider *VP-Planner Plus* a minor player, we have included it because it is both *1-2-3* compatible and expands the spreadsheet habitat to include serious database handling.

The current spreadsheets differ as much in price as they do in functionality. Street prices vary in rough proportion to list, with *Excel*, *Surpass*, and *1-2-3* all clustered near $300. *Surpass* is usually the most expensive at about $330. *VP-Planner Plus*, at under $100, is less than one-third that price, and you can pick up *Quattro* for something around $130. Clearly, *VPP* and *Quattro* are attractive to individuals who must spend their own money, but if your company is picking up dozens of copies at a time, a $200 difference can add up fast.

In the face of this competitively priced lineup, who would buy *1-2-3*? Plenty of people, and not just from force of habit. If your company already uses *1-2-3* and you just bought another computer, there are good reasons to stick with what you already know. Training almost always costs more than software, and you won't have to spend a dime on retraining. And when you bring new people in, you'll find that your local community college offers courses in *1-2-3*, not in *Quattro*.

COMPATIBLES AND OTHERS What about compatibility? *Surpass* comes near as possible to being perfectly *1-2-3* compatible, and *Quattro* and *VP-Planner Plus* are pretty close. Not one is a perfect clone, though, so you won't have full, two-way compatibility. The problem is worse if your office expects to upgrade some day. If you have ten copies of *1-2-3* and two copies of *Surpass*, what do you do when you decide to turn them all in?

This is a particularly relevant question because, though it is a top-flight product and an editor's choice, *Surpass* does not have an independent future. This spring, the company drifted close to the rocks and Borland stepped in with a friendly takeover of the *Surpass* development team. The *Surpass* program will continue to sell, but the very considerable smarts that would have gone into a next-generation *Surpass* will now be part of a future Borland product. *Surpass* owners will get the same upgrade deal as *Quattro* owners. So if you have a mixed *1-2-3* and *Surpass* (or *Quattro*) office, you'll have to decide, when the time comes, whether to upgrade

WHAT 1-2-3 RELEASE 3.0 AND SUPERCALC 5.0 PROMISE.

Just to complicate your choice of spreadsheet, we'll pass along the tantalizing things we've heard about Release 3.0 of *1-2-3*, and about the next version of one of its oldest and proudest competitors, *SuperCalc* 5.0. There's many a slip twixt cup and lip, but now both products are well defined and are likely to perform as advertised.

LOTUS 1-2-3, RELEASE 3.0 What will you get if you wait for Release 3.0? A lot. Lotus has done all the obvious things—smarter recalc, better graphs, spreadsheet links, and disk-based databases—as well as some that are not so obvious. It won't be a leap into the future, but it will be a very respectable upgrade.

One of the most useful features will be 3-D. You'll be able to build as many as 256 sheets, stacked on top of each other, stored together in memory. By writing formulas that refer to cells and ranges in multiple spreadsheets, you'll be able to consolidate with ease.

For models that won't all fit in memory, Release 3.0 promises spreadsheet links to models on disk. Whether these will be restricted to *Excel*-style absolute links or will be flexible, *Surpass*-style links wasn't clear at press time, but Lotus is trying to be flexible.

Another big improvement will be disk-based data handling. Release 3.0 will come with a driver that lets you manipulate *dBASE* files using *1-2-3* data commands. Since the database interface will be public, you can expect many database programs, from micros to mainframes, to let you use *1-2-3* as a front end. This will open up a whole new world to *1-2-3* users.

Release 3.0 will finally give you presentation-quality graphics, printing from the screen, and choices of font and color. You'll be able to display graphs and data together, and graphs will automatically update as the data changes.

Like all respectable spreadsheets these days, the new *1-2-3* will have minimal and background recalc. It will let you record macros and put them into libraries. There will be an undo function, PostScript support, and file locking for networks. And it won't be copy protected.

Release 3.0 will cost the same as 2.01: $495. Upgrade prices will be $200 for 1A users, $150 for those who own 2.*x*, and upgrades are free to anyone who buys Release 2.01 between September 6 and 30 days after Release 3 ships. Release date? "Sometime in the fourth quarter."

SUPERCALC5 According to reports from Computer Associates, we can expect great things from *SuperCalc5* when it ships later this year. It should take the best features of the current contenders and add plenty of its own.

The developers have continued their philosophy of recognizing that not everyone has a top-of-the-line machine, but anyone who does wants to get the most out of it. They also worked closely with the companies that purchased site licenses to include what their customers want in the new version. *SC5* will therefore run on a floppy-disk-based machine, but will "grow" to take advantage of whatever hardware you give it. As Martin Herbach of Computer Associates says, it will be "tomorrow's spreadsheet for today's machines."

SC5 will reportedly have spreadsheet links that are even better than those in *Surpass*, and it will have more graphs than *Excel*. Though it will not have a graphics interface, you will be able to zoom in and out of your spreadsheet to display as many or as few cells as you like. The program will use embedded printer commands to get the very best out of your laser printer: boxes, shading, and mixed fonts of all kinds. *SC5* will come bundled with Computer Associates' spreadsheet auditing program, so you can keep your models honest without ever leaving the program.

It will also have minimal, interruptible recalc. The algorithm should have enough intelligence to use minimal recalc only when this feature will actually save you time. Like *Quattro*, *SC5* will come with powerful macro debugging tools: trace cells, break points, and trace scripts that you can print or save to disk. You can keep macros in worksheets or in separate files to be run from disk.

SC5 will have a text-entry mode like *VP-Planner*'s, which wraps text to the margin of your choice. And it will have a file search path, much like the DOS path, that lets you search for worksheets sequentially across several directories.

SC5 will claim "Lotus coexistence"—not *1-2-3* compatibility. It will let you import and export worksheets and will have a translation program that can turn most *1-2-3*, Release 2.01, macros into *SC5* macros.

The price of the new version will be $495, which almost seems to be a standard price for spreadsheet packages, but Computer Associates has a generous upgrade policy. If you bought *SC4* before May 23, 1988, the upgrade is $100. If you bought it after May 23, you get a free copy of *SC5* and a $100 rebate! Too bad if you bought it on May 22.

—Jared Taylor

along the *1-2-3* path or the Borland path. Either way you lose something.

If I had to stick to the *1-2-3* standard, I would look carefully at what each compatible offers before I bought something other than *1-2-3*. The compatibles are very different from each other; about the only thing they have in common is compatibility. But if you need what one of them offers, it could be a good solution for you whether you care about the *1-2-3* standard or not.

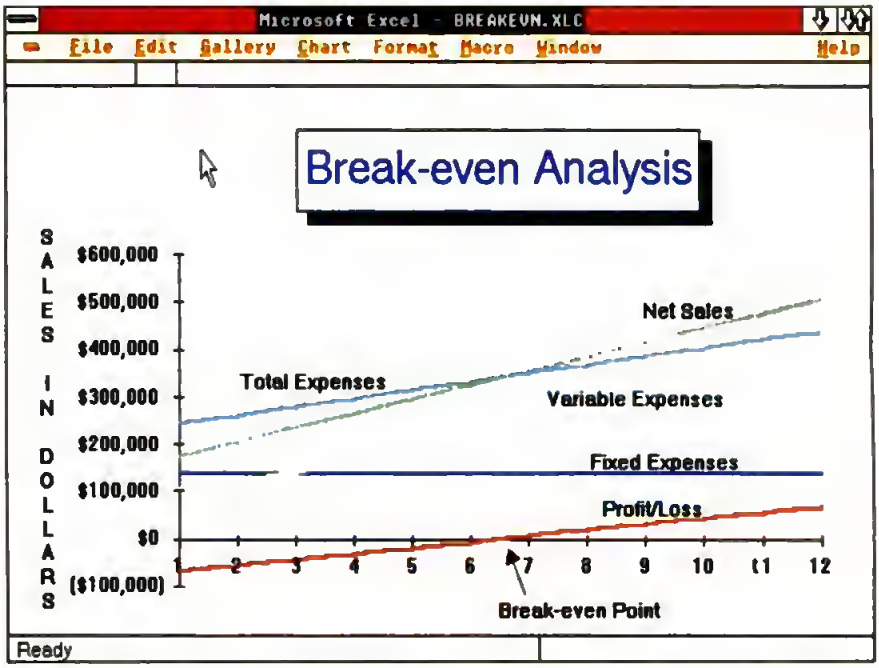
Always looming in the background of the compatibility issue is the baleful presence of the look-and-feel lawsuit. Remem-

ber the lawsuit that Lotus brought last year against Paperback Software International and Mosaic Software (see "Special Report," *PC Magazine*, May 26, 1987)? It has sunk from view and may not be decided for years, but it hasn't gone away. Some day in 1991, you may wake up to discover that *VP-Planner Plus* is illegal. If that happens, it could throw a cloud over *Surpass* and *Quattro*, too. By then, will it matter? Probably not.

If you're starting with a clean slate and don't have any Lotus baggage to carry around, you can choose what you like. Spreadsheet software has never been more powerful, more flexible, or more varied. *Excel*, our other Editor's Choice, is probably what I would buy if money, hardware, and spreadsheet links were no object. Microsoft won't be going out of business any time soon, and the graphics interface is a window on the future of computing. Besides, the developers at Microsoft won't sit still; *Excel* will only get better.

And finally, all the talk about compatibility shouldn't obscure the fact that *1-2-3* isn't the only standard. On the Mac, Microsoft has set the standards. So if you're introducing PCs into an Apple environment, you should think hard about *Excel*. It's the only PC spreadsheet that looks or acts like anything Mac users have seen before, and it could save you months of training time.

Choice is freedom, but choice is agony. Without choice you have no way to express yourself, but you also have no fear of choosing wrong. We hope the reviews that follow will help you choose right.



This Microsoft Excel *graph shows the flexibility and detail with which data can be represented.*

Microsoft Excel

Microsoft Excel ($495) is one of those rare programs that do just about everything right. It is the work of a team of developers, yet has a single, clear personality. It is a bold move beyond the Lotus standard, yet is *1-2-3* compatible at almost every turn. It is stuffed with features that even power users may not find, but it never seems cluttered or intimidating. On the right machine—a 386 or at least a fast AT—it is a convincing demonstration of where spreadsheets are going.

A large measure of *Excel*'s personality comes from its *Windows* interface. The commands are in Mac-style pull-down menus, and the screen divides into as many as 24 windows, all of which can be moved and resized at will. This means you can display multiple spreadsheets, or graphs and data, simultaneously. And *Excel*'s pure graphics screens mean that a spreadsheet's appearance is almost infinitely variable.

You can have up to four different font styles in the same sheet, all in different colors. You can vary the height of a row as well as the width of a column to make spreadsheet titles look like titles. You can underline or draw boxes around critical values, or draw attention to parts of your work by selectively shading the background. The effect is startlingly different from *1-2-3*'s olive drab or even *Quattro*'s lively colors.

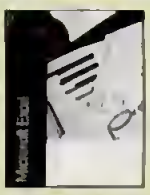
Display formats are just as flexible. There are 21 standard display formats for numbers, dates, and time. If that's not enough, you can design your own formats that automatically append currency symbols, for example, or insert dashes into social security numbers. And it's easy to set thresholds so that numbers above or below them show up in different colors.

All this fancy maneuvering is surprisingly easy if you want to mouse your way through the menus. But once you know which commands you need to run quickly or often, chances are there are keyboard shortcuts for them. *Excel* has gone slightly nuts over function keys. For example, there are *seven different ways* to use F2, including Alt-Ctrl-Shift-F2. Bizarre combinations like Ctrl-Shift-Spacebar also do

EDITOR'S CHOICE

PC MAGAZINE

FACT FILE



***Microsoft Excel*, Version 2.0t**
Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, WA 98073
(206) 882-8080
List Price: $495

Requires: 80286- or 80386-based AT, 640K RAM, hard disk drive, graphics monitor, DOS 3.0 or later. EGA, expanded memory, and mouse recommended.

In Short: The state-of-the-art PC spreadsheet. Not copy protected.

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Look&Link
Add-in for 1-2-3

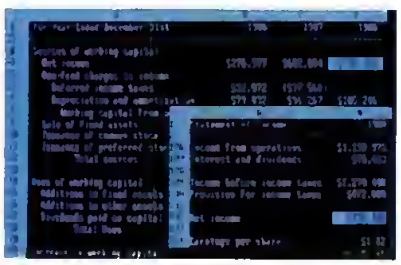
With dynamic linking you can build giant 1-2-3 applications and you'll never run out of memory. Values from linked sheets automatically feed into the primary sheet.

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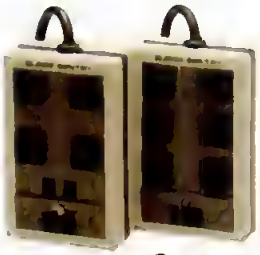
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BLOCKING EXCEL'S ADVANCES

Microsoft worked feverishly to ship *Excel* for the PC by Thanksgiving 1987, hoping that a few months' lead time before the advent of *Lotus 1-2-3*, Release 3, early in 1988 (some rumors said as early as February 1988) would help build momentum for *Excel*.

Now Microsoft will have a year's lead selling against Lotus's lame-duck Release 2.01. And you know what? Microsoft might have been better off if *1-2-3*, Release 3, had shipped on schedule. Some corporate buyers are still holding off their mass-purchase decisions until they can see Release 3 in the flesh. And that's holding back acceptance of *Excel*.

Microsoft is in the same boat as hardware vendors have been before the arrival of an impending IBM product. Laptop sales stalled in early 1986 as rumors flew about an IBM laptop: 286 processor . . . weighs less than 7 pounds . . . $2,000 with a 30MB hard disk. Once the PC Convertible surfaced in April 1986, everyone took one look, shook their heads, and went back to buying Toshiba, Zenith, and NEC laptops.

Once Release 3 ships, users may decide it's good old *1-2-3* with linked worksheets and feature upgrades that should have been made 3 years ago. Then they'll be free to choose. Unless Lotus tells them, "Just wait till you see *1-2-3/G* with the graphical interface. It won't be long. . . ."—**Bill Howard**

Bill Howard is an executive editor of PC Magazine.

useful things. The point is not to learn all of the shortcuts—just the ones you're likely to use.

Though not as flashy as its windows, colors, and mouse control, the work that goes on behind the scenes is just as important. Recalculation, for example, has been improved over *1-2-3* in two ways. First, *Excel* uses a minimal recalc algorithm that recalculates only those formulas that need to change, not every formula in the spreadsheet. Also, if you are working with a big model, *Excel* suspends recalc if you hit the keyboard before the recalc is finished. When you pause, calculation starts up again.

Excel has also made a stab at linking spreadsheets, but there are irksome limits to what you can do. For example, if you want a formula to refer to a cell in another spreadsheet somewhere on-disk, you must use an *absolute* reference. If it's a relative reference, the other spreadsheet has to be in memory. What's more, if you have a single formula that refers to more than one external spreadsheet, they *all* have to be in memory, even if the references are absolute.

One of the main advantages of spreadsheet links is that they let you break big models into manageable chunks. With *Excel* the chunks had better be very manageable, since they may all have to fit into memory together. Links are one of the few *Excel* features that aren't first rate, and their limits will soon have you longing for *Surpass*'s adroit Hot Links (a trademark of Surpass Software).

The real nuts and bolts of most spreadsheets, however, are mathematical functions, and *Excel* has 132 of them—42 more than *1-2-3*. This includes specialized functions like growth() and logest(), which give values and parameters of an exponential trend. If you forget the name of a function, use the Paste Formulas command. *Excel* displays an alphabetical list of functions, and you can copy what you need right into your spreadsheet. If 132 functions aren't enough, you can design more. If you often calculate the volume of a sphere, you can design a function that takes radius as its argument and returns volume. Custom functions show up in the Paste Formulas list, at the end rather than in alphabetical order.

TROUBLESHOOTING TOOLS Some of *Excel*'s best and most powerful features are its unsung auditing tools. The more complex your spreadsheet, the better your chances of doing something wrong, *and* the worse your chances of ever knowing it. *Excel* gives you several lines of defense. First, you can annotate any cell with a memo explaining the assumptions behind a value or formula. Even better, you can trace a cell's upstream or downstream references, then list them in a box or highlight them on the screen. This is a priceless tool for tracking down faulty logic.

Another great troubleshooter checks your spreadsheet's patterns. If you select an area that is supposed to consist entirely of formulas, *Excel* warns you if any labels or constants have crept in. The program will even look for formula patterns. If, for example, a whole bank of cells is supposed to multiply the cell above by the cell to the right, *Excel* spots deviant formulas that do something else. If you find an error that is consistent throughout the spreadsheet, you can fix every occurrence at once with *Excel*'s search-and-replace function, which works with both labels and formulas.

Another trick to help keep spreadsheets honest is to use range names. A name like TAXRATE is easier to remember than a cell address, and most spreadsheets let you name ranges. *Excel* goes one step further and does a lot of the naming for you. For example, you may have a matrix of monthly budget items, with a column for each month and rows for things like Rent and Wages. With the Apply Names command, the intersection of the April column and the Rent row gets the name April Rent, and so on throughout the entire matrix. You can now use the names April Rent and July Wages in any formula that refers to these cells, and you're far less likely to make errors than if you're using cell addresses.

■ The real nuts and bolts of most spreadsheets are mathematical functions. *Excel* has 132 of them—42 more than *1-2-3*—and you can design more.

Also, if someone else has to figure out your spreadsheet logic, it'll be that much easier.

If you need a new perspective on a strange spreadsheet, you can take the bird's-eye view. If you cut the type size of the model down so small that it's barely readable, you can get up to six times as many cells on-screen as normal. Even on that scale, all the editing tools still work, so you can change things immediately.

If, despite all these useful techniques, you still end up with illegal formulas, *Excel* has seven different error messages. This level of detail makes it much easier to figure out what went wrong. And if you have hopelessly botched things, you can always cancel your last operation by using *Excel*'s invaluable Undo command.

CHARTS AND GRAPHS As you might expect from a graphics-based program, *Excel* has fine charts and graphs. There are 44 different predesigned charts based on seven basic types. You can modify any of them, and if the results are particularly good you can store them as customized chart formats.

Since charts appear in separate windows, you can watch them update immediately as the data changes. You can work with text of any size in several fonts and put it anywhere you like on a graph. For emphasis, you can then draw an arrow to any data point you want to highlight.

But *Excel*'s handiest graphing feature is its intelligence. For most charts, all you have to do is highlight the data, complete with labels, and move to the graphing command. *Excel* understands what the labels along the top and sides mean and puts them on the chart right where they belong. If you want fancy titles or custom colors, you can add them later.

For really sophisticated graphing jobs, you can lay one chart over another. You could, for example, combine a high-low-close stock chart that had a vertical scale from $30 to $50 with a trading volume chart for the same stock that had a vertical scale from 10,000 to 100,000.

Vertical scales can be linear, logarithmic, or semilogarithmic, and if necessary charts can refer to data from more than one spreadsheet. You can print any chart without leaving the program.

Benchmark Tests: Spreadsheet Programs

Five spreadsheet programs were put through their paces by PC Labs. Although *Lotus 1-2-3* was not reviewed in this issue, we tested *Lotus 1-2-3*, Release 2.01, both with and without the *Lotus Speedup* add-in program. All test results are normalized against *1-2-3* without *Speedup* installed.

Microsoft Excel's minimal recalculation function is ideally suited to the Mathematical Worksheet Recalculation test; however, on the Loan Recalculation and Internal Rate of Return Recalculation tests, *Lotus 1-2-3* with and without *Speedup* was faster. Because the loan worksheet requires that all cells be recalculated, minimal recalculation is not an advantage here. A program with an efficient internal rate of return algorithm still wins hands down.

Excel takes up the most memory both with and without a worksheet loaded. Its slowness on the Load from Disk and Save to Disk tests indicates a higher overhead requirement when loading and saving the test file, which was originally created in *Lotus 1-2-3*, Release 2.01.

Surpass performs fewer overhead functions on the test file, and the small amount of disk space it uses shows that the file, as saved to disk, was compact. Intelligent recalculation is behind *Surpass*'s good showing on the Mathematical Worksheet Recalculation test.

Quattro's results on the Load from Disk and Save to Disk tests indicate its capability to easily load and save files originally created in *1-2-3*. *Quattro*'s recalculation times are less impressive, and the test file *Quattro* saved to disk uses the most disk space.

Though *Lotus 1-2-3*, Release 2.01, does not have minimal recalculation, it turns in fast performance times on these tests because of an efficient calculation algorithm. *Lotus 1-2-3* with *Speedup* uses minimal recalculation to obvious advantage on our tests.

Surprisingly, *1-2-3* with *Speedup* did not load and save the test file as quickly as did *Surpass*, *Quattro*, and *VP-Planner Plus*.

PC Labs' five timed benchmark tests for spreadsheets are measured in seconds from the initial keystroke that executes calc functions and commands to the moment results are displayed on-screen or keyboard control has been regained. Memory and disk space are measured in kilobytes, using each spreadsheet program's memory and space check functions.

The products were tested on an 8-MHz IBM PC AT with a 30MB hard drive and 640K RAM. In the interest of standardizing our approach and results, we did not use *Quattro*'s built-in data compression utility, *SQZ!*, which reduces disk space utilization. We also did not use *Quattro*'s alternate *1-2-3*-style menu. In addition, manual recalculation was used for the recalculation tests. *Excel*, *VP-Planner Plus*, and *Surpass* use background recalculation when automatic recalculation is enabled; therefore improved performance would be evident in these three packages when recalculating spreadsheets in background mode.

The **Mathematical Worksheet Recalculation** test measures the time a spreadsheet program takes to calculate an 80,624-byte worksheet created in *Lotus 1-2-3*, Release 2.01, holding 1,950 mathematical functions (square root, addition, subtraction, multiplication, division, and @SUM) and 494 cells with text labels requiring no recalculation.

The 63,319-byte **Loan Recalculation** test worksheet calculates the monthly payment and displays the amortization schedule for a 30-year mortgage for any given loan principal. All columns except the payment (or month) number require recalculation.

The 12,076-byte **Internal Rate of Return Recalculation** test worksheet calculates the Net Present Value and Internal Rate of Return for 25 different 5-year cash flows. Only the 25 Internal Rate of Return formulas require recalculation in this test; there is no need to recalculate the 150 Net Present Value formulas. The Internal Rate of Return and Net Present Value are both computation-intensive formulas and test a program's calculation and Internal Rate of Return algorithms.

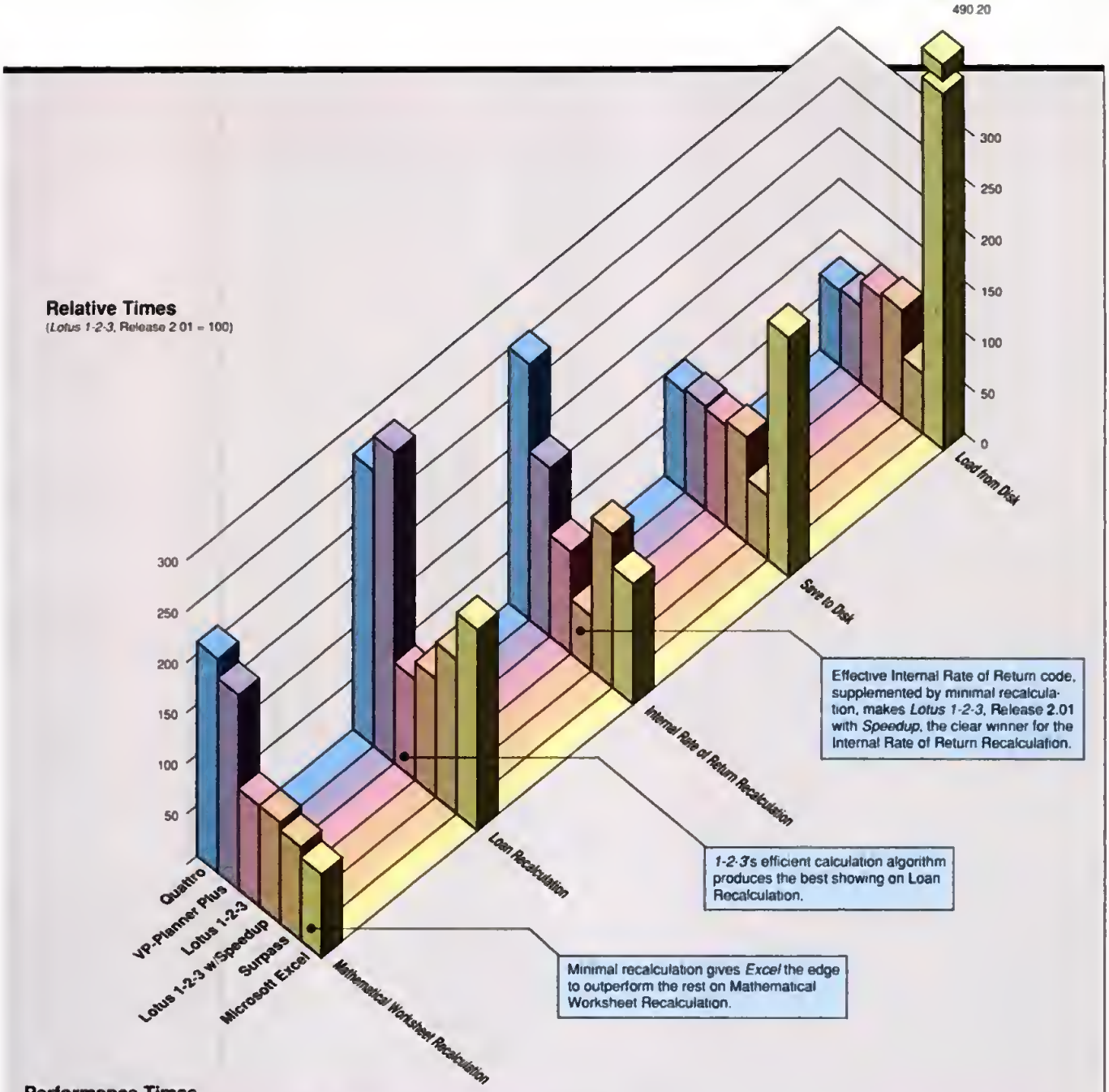
The **Save to Disk** test measures how long it takes the spreadsheet program to write the Mathematical Worksheet Recalculation test file to disk in its native file format.

The **Load from Disk** test measures how long it takes the program to read the test file from disk in its native file format.

Conventional Memory reports how much RAM is available when the spreadsheet program has been called but no spreadsheet file has yet been loaded. A larger number on this test indicates better performance, as more RAM will be available for spreadsheets and TSRs.

Memory Remaining reports how much RAM is available after the test file has been loaded. A larger number means more memory is available to create larger spreadsheets, run other programs simultaneously, and perform overhead operations.

Disk Space reports the file size of the test file when the program writes it to disk in its own native file format.



Performance Times

(Times given in seconds, memory and disk space given in kilobytes)

	Mathematical Worksheet Recalculation	Loan Recalculation	Internal Rate of Return Recalculation	Save to Disk	Load from Disk	Conventional Memory	Memory Remaining	Disk Space
Quattro	126.57	4.12	6.12	3.71	4.43	256	155	81
VP-Planner Plus, Version 2.00	115.28	4.65	4.02	3.84	4.54	335	254	80
Lotus 1-2-3, Release 2.01	59.83	1.52	2.43	3.75	6.02	411	327	81
Lotus 1-2-3, Release 2.01 w/Speedup	59.69	1.78	1.30	3.92	6.29	303	216	81
Surpass, Version 1.01	55.08	2.32	3.66	2.37	3.56	307	220	80
Microsoft Excel, Version 2.0	48.98	3.02	2.88	8.85	29.51	209	126	79

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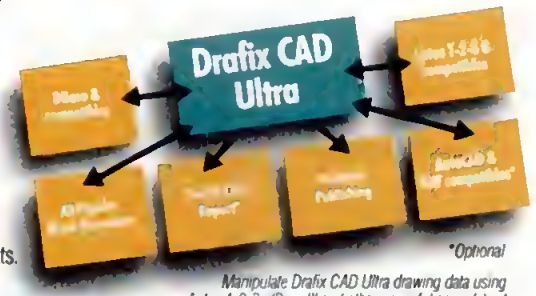


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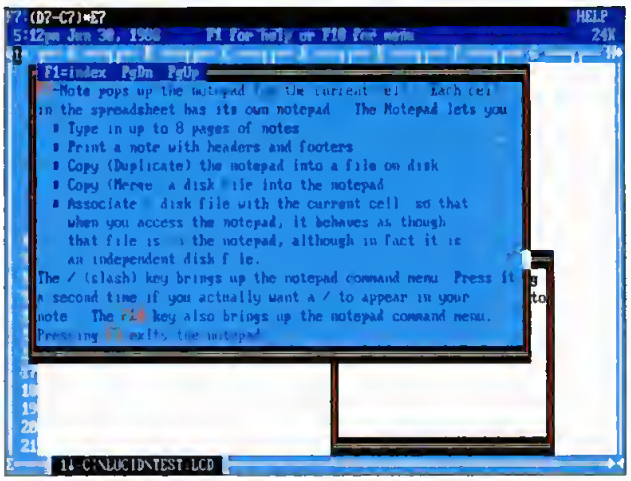
Lotus 1-2-3

LUCID-3D: PICKING UP THE ADD-IN LEADS

As the winds of change sweep through the spreadsheet market, the Personal Computer Support Group (PCSG) offers us yet another alternative to the *1-2-3* standard: *Lucid 3-D*. Derived from a popular 8K ROM spreadsheet for the Tandy 100, *Lucid 3-D*, at $199, is a mix of features seen in *Lotus 1-2-3*, *Quattro*, *Microsoft Excel*, and *1-2-3* add-ins—garnished with PCSG's own innovations and style.

The *Lucid 3-D* installation is extremely simple, but many users may opt for copying files and editing their AUTOEXEC.BAT instead of using the installation program, which changes both your AUTOEXEC.BAT and CONFIG.SYS files. Although *Lucid 3-D* is normally a memory-resident program that uses 160K when resident, you can use the /N switch to make it a standalone program. Other switches help you configure the package (/S), unload *Lucid 3-D* from memory (/U), and automatically load a macro (/M). To invoke *Lucid 3-D*, hit a Ctrl-Left Shift, and it will pop up in your application.

Lucid 3-D's work area looks similar to that of the *1-2-3* standard. Cells are arranged in rows and columns, ranging from A1 to IT9999. Although the cursor arrows function the same way as in *1-2-3*, the Home key is used like the End key, requiring a second key to move the cursor to the edge of the spreadsheet in a given direction. PgUp, PgDn, and the Tab keys take you to the end of the current screen before paging onto others. For those of you who use a mouse, PCSG has built in an effective mouse interface that streamlines your use of the package.



Lucid 3-D's context-sensitive help is displayed in a window. You just use PgUp or PgDn to browse through the help window and view further topics.

EASY FUNCTION DEFINITION As with the work area, the entry of data, formulas, and functions is much like that found in *1-2-3*, but with subtle changes. Although its formulas often start with a + or a −, and functions with an @, *Lucid 3-D* parses the expression with or without them. Besides the 51 built-in functions, *Lucid 3-D* includes an easy yet powerful method for defining your own functions. Also you can pop up a window and add a multipage note to the current cell. Editing is quite simple, and several word processing features make the notepad a powerful tool for documenting your work.

Lucid 3-D uses a combination of menu bars and pull-down menus to help you modify the spreadsheet. Both the Slash key and F10 invoke the first menu bar; your selection produces another menu bar under it. *Lucid 3-D* displays choices with multiple options, such as print settings, as pull-down menus on which you can change options and complete the task by hitting F10. Moreover, *Lucid 3-D* is full of shortcut keys to save keystrokes, such as Ctrl-N for creating a range.

FINE-TUNING TRICKS Once you've entered your data and formulas, you'll find an amazing bag of tricks to help you build and fine-tune your spreadsheets. To copy information, you first store it in *Lucid 3-D*'s clipboard. You then highlight the destination and paste the clipboard data or formulas into it. Since *Lucid 3-D* is memory resident, you can pop out to your application and paste the same data into it. Information on the cur-

PRINTING OPTIONS When you print regular worksheets, you have many powerful options to choose from. If you have a laser printer, you can design *Excel* templates to print customized invoices, purchase orders, travel vouchers, or any other form you commonly use. With shading, grid lines, and a variety of fonts, your forms will look handsome, and since they have the intelligence of *Excel* behind them they can do calculations and check for correct data types as you fill in the blanks.

No matter how complicated your print job, *Excel*'s preview feature eliminates the guesswork. You can look at a screen image of each page before you send it to the printer. You'll see the layout, relative font sizes, spacing, and how your titles will look. When you view a whole page, the text may not be readable, but you can blow up any spot you like to make sure it says what it should.

Throughout the program, the designers of *Excel* have added nice touches. For example, if you need to execute the same command several times, Ctrl-Enter is a repeat key. F5 is the standard Goto key for moving around the spreadsheet, but the default destination is the last place you moved. This makes it easy to hop back and

rent screen can also be captured and pasted into *Lucid 3-D*.

To simplify the building of more-complex models, you can display up to nine windows, each containing a section of the same spreadsheet or different spreadsheets. The size of each window can be adjusted, and you can zoom in temporarily to analyze a particular problem. Using the mouse interface, these adjustments can be made effortlessly.

You can create macros in *Lucid 3-D* to automate repetitive processes by capturing keystrokes and assigning the sequence to a single keystroke. Using the macro menu you can also pause for data, wait for certain keys, and test for conditions. Once you've finished creating the macros, you save them to a disk file. To change an existing macro, you must return to DOS and use PCSG's EDMAC program, adding a little clumsiness to a relatively smooth interface.

Since *Lucid 3-D* is limited to a 57K work area, you have no choice but to organize your work into modules and smaller data groups. To ease the process, *Lucid 3-D* includes a linking capability that ties one cell in the current spreadsheet to a cell in another spreadsheet. When you need a number from a subsidiary schedule, move the cursor to a blank cell and hit the gray Plus key (on the numeric keypad). You can now create a new file or link to an existing file. You then place your cursor on the cell with the result that you need and hit the gray Minus key to return to the first spreadsheet. Since each schedule is a new file, very little of your 57K is used.

Lucid 3-D's documentation includes a quick-start guide, a tutorial guide, a reference guide, and a useful list of commonly asked questions. The quick start is brief, but it's all you need to get going. The tutorial is thorough, very easy to use, and it covers just about every topic concerning *Lucid 3-D*. The reference is an alphabetical list of commands that succinctly explains each one and gives you detailed steps for using it.

FUTURE PLANS *Lucid 3-D* is impressive but has room for improvement. Adding another memory-resident program to your repertoire may use up too much memory, limiting the value of some of its features. If you want to use EMS memory, you'll need PCSG's *Lightning*, or, with only a 57K work area, you'll need to organize your work a little better. Building formulas with the cursor movement keys seems clunkier than building formulas with *1-2-3*. You can link one cell to another only with the 3-D function, so linking a range of numbers is a tedious process. Although most spreadsheets now retrieve and save in *1-2-3*'s .WK1 format, PCSG requires you to run the file through a conversion program before you load it.

PCSG is currently working on Version 2.0 of *Lucid 3-D* and expects to correct many of the above concerns. In addition, the company plans to speed up the calculation of linked spreadsheets and improve the performance of clipboard functions and other processes. PCSG still doesn't plan to include a graphing capability but instead will include an interface to *Graph-in-the-Box* from New England Software.

Lucid 3-D gives you most of the functionality of several spreadsheet products and a bunch of add-ins for a low price. The mouse interface is well designed, and the feel of the program is close enough to *1-2-3* to satisfy the more traditional users. Whether you need the features or you want to switch is up to you.
—Mike Falkner

Mike Falkner is an independent microcomputer-consultant based in Sacramento, California.

PC MAGAZINE FACT FILE



Lucid 3-D, Version 1.22
Personal Computer Support Group Inc.
4540 Beltway Dr.
Dallas, TX 75244
(800) 544-4699
(214) 404-4000

List Price: $199
Requires: 256K RAM, two disk drives (hard disk recommended), graphics monitor, DOS 2.0 or later.
In Short: A powerful spreadsheet that includes the best of most other spreadsheets and add-in products, plus a few nuances and quirks of its own. Relies on other packages for graphs but uses only 160K when memory resident. Not copy protected.

CIRCLE 687 ON READER SERVICE CARD

forth between parts of your model without memorizing cell addresses. *Excel* works like a simple database much as *1-2-3* does, but it has a more convenient way to enter records: You can add them via a Forms window rather than stringing them out in a single row. In addition, *Excel* has an expandable editing window. Instead of scrolling maddeningly off the screen, long formulas wrap neatly into an editing window that grows only as large as necessary.

Finally, if you find that you often work with the same combination of native spreadsheets or graphs, you can save the whole thing in a bundle as a "workspace." The names, relations, and settings of the different documents are all preserved. When you reopen the workspace, the entire package reappears just as you left it. You can save as many different workspaces as you need and still load and modify the individual documents at any time.

APPLICATIONS UNLIMITED *Excel* was built to be customized. With an astonishing 355 different commands to choose from, its macro language is clearly the most powerful available in a micro-based spreadsheet. Macros stay in their own separate sheets, so by separating "code"

from "data" you can write routines to operate across many worksheets.

As you would expect, you can use FOR-NEXT and WHILE-NEXT loops, subroutine calls, conditional branching, and sophisticated error traps. You can also use macros to build custom menus, help screens, and dialog boxes that have the full interactive power of *Excel* itself. Auto-executing macros can be designed to run not only when a file is opened but when one is closed, when a critical value changes, or when other conditions are met.

Other macro commands of enormous use to developers give you information about the current worksheet. You can find out what directory it's in, how many columns and rows it uses, whether it's a chart, or whether the user has changed anything since it was last saved. This way your macros won't fly blind; they can monitor for changes and user input while they work.

Macros are also the gateway to Dynamic Data Exchange (DDE). When you run *Excel* under *Windows* along with other DDE-capable programs, they can load and unload each other and transfer information automatically. If you are a programmer, you can even use certain macro commands to call custom C routines.

For users who don't expect to write custom C routines, *Excel* comes with training wheels. There is a disk-based tutorial that introduces essential functions, and one of the most extensive help systems you're ever likely to see. If you're new to spreadsheets you can even turn off the more advanced menu choices.

Microsoft has tried to make it as easy as possible to graft *Excel* onto the world that grew up with *1-2-3*. *Excel* reads *1-2-3* worksheets with surprising accuracy, sometimes mimicking a Lotus display more closely than *Quattro* does. It comes with a *1-2-3* macro translator that I expected to be a joke, but which tries very hard. *Excel* chokes on self-modifying macros and other sophisticated script but is aware of its limitations. When it happens to get a macro wrong it usually issues a warning, along with its best guess about why the macro couldn't translate. Unfortunately, it takes a thorough knowledge of *Excel*'s macro language to fix a dud, so don't translate tricky templates unless you're willing to tinker with the results.

Excel has clearly stepped out in front of the pack. If you've got the hardware, it's got the horsepower. If you want the best there is, can overlook a few *1-2-3* incompatibilities, and can pay full price, *Excel* is the spreadsheet for you.

Quattro

Quattro ($247.50) combines all the features we have come to expect from Borland products: low price, good looks, a flexible user interface, and features to spare. All this and vigorous promotion have made *Quattro* a popular choice for anyone willing to stray from the Lotus standard.

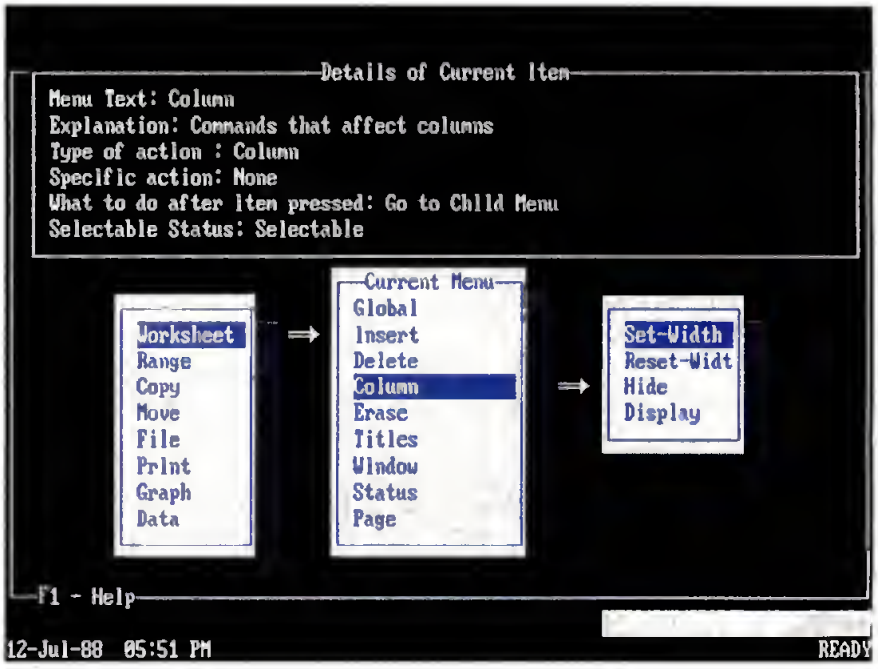
Quattro may not, however, make you happy. There is an unevenness about it that discourages discriminating users. Its recalculation scheme can be both lightning fast and grindingly slow. Its apparent *1-2-3* compatibility is marred by subtle but dangerous bugs.

I don't entirely agree with *Quattro*'s designers about what's important in a spreadsheet. Its user-adjustable interface is very fine, its graphics are marvelous, it has a built-in add-in manager, and it's comforting to know that I can reconstruct my work if the power ever goes out. And yet I'm not the only spreadsheet user who would give all that up if, instead, I could link spreadsheets, work with disk-based data, or even just run macros from libraries. *Quattro* is a program I would love to love, but can't.

Still, there's a lot to like. *Quattro* has the most flexible and versatile user interface ever found in a spreadsheet. If you are used to *1-2-3* command sequences, you can tune *Quattro* to mimic it perfectly. The commands available in *Quattro* but not in *1-2-3* show up as additional choices in menus that are otherwise completely familiar. If you run it this way, *Quattro* is an upwardly compatible superset of *1-2-3*.

COMMAND STRUCTURES However, many users prefer to run *Quattro* with its native menu structure, which integrates its additional features into a more logical command tree. Native mode has other advantages. Every time you choose from a menu, *Quattro* "remembers" your choice. The next time you come back to that menu, the highlight is already on that choice. This way, if you need to repeat the same complex command, you can do it just by hitting Enter several times.

If you don't care for either command



With Quattro's menu-builder add-in, you can customize the command tree by changing the entries on the menu.

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Spreadsheet Programs: Summary of Features

(Products listed in ascending price order)

The following table summarizes the differences in features among *Quattro*, *VP-Planner Plus*, *Microsoft Excel*, and *Surpass*. These four spreadsheets also have many features in common.

All support both 8087 and 80287 math coprocessors. Each program accepts nonalphanumeric symbols in the filenames and allows customized file extensions. Each can import and export files in ASCII as well as *Lotus 1-2-3* .WKS and .WK1 formats and will warn you if you try to overwrite a file.

Common screen-manipulation features include control of screen colors; independent scrolling and formatting of both portions of a split screen; the ability to hide cells, columns, titles (both vertical and horizontal); and cell protection. You can search data records by both arithmetic and logical criteria, and each program can recalculate by row, column, automatic, natural, or manual methods.

Although none of the programs have customizable printer drivers, each produces multifont output and can print a graph directly from the screen. You control graph coloring both on-screen and when printing.

Shared macro functions include auto-load, learn mode, looping, macro menus, macro branching, and conditional gotos. You can import *1-2-3* macros, and menus are available through macros.

All have context-sensitive on-line help and coexist peacefully with *SideKick*.

	Quattro $247.50	VP-Planner Plus $249.00	Microsoft Excel $495.00	Surpass $495.00
GENERAL FEATURES				
RAM required	512K	384K	640K	512K
Hard disk storage required for complete program	384K	360K	5MB	1.5MB
Uses LIM EMS 4.0	●	○	●	●
Uses extended memory	○	○	●	○
LAN version available	○	○*	●	●
HARDWARE				
Full-page monitors	○	○	●	●
Mouse	● (limited)	○	●	○
80387 math coprocessor	●	○	●	○
FILE FORMATS				
Imports/exports *dBASE* (.DBF)	●●	●●	●●	○○
Imports/exports .DIF format	●●	●●	●●	○○
Imports/exports *Multiplan* files	○○	●○	●●	○○
Imports/exports *Symphony* files	●●	○○	●●	○○
SIZE OF WORK AREA				
No. of rows	8,192	9,999	16,384	8,192
No. of rows displayed (worksheet area only)	20	20	Variable	20
No. of characters displayed (across screen)	76	76	Variable	76
No. of columns	256	256	256	256
Column-width range	1–240	0–240	0–255	1–240
OPERATIONAL FEATURES				
Undelete function	● (add-in)	●	●	●
Displays high-bit ASCII characters (128–155)	●	●	○	●
Displays formulas in worksheets	○	○	●	○
Programmable hotkeys for shortcuts	●	○	○	○
Can hide rows	○	○	●	○
User-customizable automatic backup interval	○	●	○	○

PC—Indicates Editor's Choice ●—Yes ○—No
N/A—Not applicable: *Windows* does not use setup string.
*Current version will run on Novell network.

(continues)

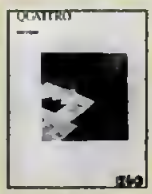
structure, you can build your own. As a first step, you can design shortcuts. It's very easy to set up the keyboard so that Ctrl-P, for example, takes you immediately to a print command you would normally reach only by going through many menus. You can use any Ctrl-letter combination as a shortcut.

If you're more ambitious, you can use a special menu-building add-in that Borland supplies with every copy of *Quattro*. It takes only a few keystrokes to "attach" the add-in, so you can use its commands just as if they were part of *Quattro*. Now you can rearrange the command menu any way you like, moving commands from one menu to another and building your own menus and submenus. You can even include menu commands that launch macros. I know of no other spreadsheet that gives the user anything like this much control over the interface.

You can use the add-in to build as many different menu trees as you like. If you want, you can save them on-disk as alternative menus, which you can switch to without even leaving *Quattro*. You might want to do this if you normally use a custom menu but need to switch to a *1-2-3*-style menu in order to run *1-2-3* macros.

Quattro comes with another add-in that lets you keep a disk log of all the keystrokes that have gone into your work since you last saved it. This is useful on the off chance that the power goes out while you are working and you need to reconstruct a spreadsheet. However, you're more likely to use it as an "undo" feature. If you make

PC MAGAZINE FACT FILE



***Quattro*, Version 1.0**
Borland International
1700 Green Hills Rd.
Scotts Valley, CA 95066
(800) 543-7543
(408) 438-8400
List Price: $247.50
Requires: 512K RAM, two disk drives, DOS 2.0 or later.
In Short: An inexpensive, *Lotus 1-2-3*–compatible spreadsheet with many powerful features not found in *1-2-3*. Not copy protected.

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Software Developers



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The Activator - Natural Selection For Software Protection



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Canon
PRINTERS
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CIRCLE 535 ON READER SERVICE CARD

a terrible mistake, you can snatch it back by reconstructing the spreadsheet up to that point. And reconstruction is much faster than you'd think: *Quattro* rebuilds your model internally and updates the screen only when it's finished. If you don't need the 12K RAM that the add-in requires, you might want to set up the program to load it automatically every time you enter *Quattro*.

FILE COMPRESSION One of *Quattro*'s best features is available in other spreadsheets only as an accessory: file compression. *Quattro* has Turner Hall's *SQZ!* built right into it, so you can compress files every time you save them. The standard compression routine shrank a formula-heavy spreadsheet down to 17 percent of its original size. If you really need to save space—because you're transmitting a file or carrying several around on a floppy—you can use a super-compression routine that strips out displayed values and saves only formulas. The spreadsheet then has to recalculate as soon as it reloads, but this way *SQZ!* crammed the same spreadsheet into an astonishing 3 percent of the original disk space. Compressed saves and loads are only slightly slower than normal ones, so there's very little overhead.

DISPLAYING AND PRINTING GRAPHS Another feature that takes *Quattro* far beyond *1-2-3* is the quality of its graphs. Its ten different graph types are almost as beautiful and versatile as *Excel*'s. You can control the colors and add text in a variety of fonts and sizes. You can add or subtract grid lines, manually set the *x* and *y* scales, choose the increments and frequency of scale numbers, and even display specific data values beside the data points. If you like pie charts, you can choose the colors or fill patterns for the slices and explode any or all of them. But perhaps most impressive, you can show different data sets on the same graph in different styles. If, for example, you showed regional sales figures as bars, you could draw attention to total sales figures by showing them as a line that floated above the bars. By mixing different styles of data representation, you can build custom charts that display your data exactly as you want it.

Graph printing is equally versatile. You

Spreadsheet Programs: Summary of Features

(Products listed in ascending price order)

	Quattro $247.50	VP-Planner Plus $249.00	PC Microsoft Excel $495.00	PC Surpass $495.00
OPERATIONAL FEATURES				
Max. no. of split screens	2	6	Limited only by memory	2
Multifont graphs on-screen	●	○	●	○
3-D spreadsheet linking	○	○	● (unlimited)	● (unlimited)
MENUS				
Custom menus	●	○	○	○
Menus can be moved to top or bottom of screen	○	●	○	○
RECALCULATION				
Background	○	●	●	●
Intelligent	●	○	●	●
FUNCTIONS OPERATORS				
Total no. of functions				
Math (including trigonometry)	19	21	22	17
Logic	6	9	6	7
Date and time	12	15	12	11
Statistics	14	18	25	14
No. of logical and arithmetic operators	11	17	13	13
MACROS				
Has macro libraries	○	○	●	●
Macros reside in worksheet/library	●○	●●	○●	●●
DATABASE FEATURES				
Database larger than spreadsheet	○	●	○	○
Database resides partly on-disk	○	●	○	○
No. of simultaneous sort keys	5	4	3	2
Database entry screen	○	●	●	○
Multidimensional database	○	● (5 levels)	○	○
PRINTING FEATURES				
Landscape printing	○	●	●	○
Landscape printing with separate utility	●	○	○	○
Box/shade output	○○	●○	●●	○○
Supports PostScript printing	●	○	●	○
Maximum length of setup string	39	40	N/A	39
Multifont graphs	●	○	●	●
HELP DOCUMENTATION				
Separate help section	○	○	●	○
Quick Start booklet	○	○	●	○
Keyboard template	●	○	●	●
Reference card	○	○	●	●
Tutorial program or booklet	●	●	●	○
Command table	●	○	○	○
THIRD-PARTY UTILITIES ADD-ONS				
Supports *Sideways*	○	○	○	●
Supports *SQZ!*	● (built in)	○	○	○

PC—Indicates Editor's Choice ●—Yes ○—No

N/A—Not applicable. *Windows* does not use setup string.

*Current version will run on Novell network.

(ends)

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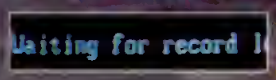
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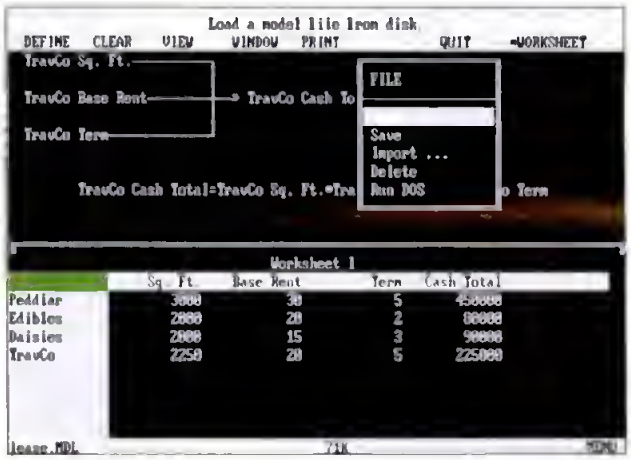
JAVELIN PLUS: UNCONVENTIONAL DATA VIEWING

As *1-2-3* evolved into the spreadsheet standard, we became accustomed to thinking in rows, columns, and cells. When Javelin Software introduced *Javelin* in 1985, the developers bucked that trend with a tool for people who want to look at data in many different ways. Now, two versions later, *Javelin Plus* is the result of numerous improvements on this unique approach.

Unlike the cell orientation of *1-2-3*, *Javelin Plus* ($395) relies on several "views" of the data to help you build a model. Instead of using cell names like B5 and Q27, you enter data in the Formula View with variable names like Widgets or Sales. Each variable can be a constant, or the result of a formula or function applied to other variables, or a table of values. You can add variables in any order, and *Javelin Plus* will continually update the view, displaying the variables that have not been defined.

Javelin Plus can display one or two views at a time. As you work on formulas in the top half of the screen, you can switch to the bottom half and enter values in the table view or use the diagram view to examine the relationships among variables. Or you can compare a graph with the raw data it represents.

By selecting the Notes View, you can store notes about each variable. If you like the spreadsheet approach, just use the Worksheet View to enter variables on the left, time periods or column headings along the top, and values in the worksheet. Once the data is entered, you can request either a chart view or a quick graph view and change the displayed values by using the Cursor Up and Down keys.



As in Lotus 1-2-3, *the Slash key invokes the menu in* Javelin. *You select items from a pull-down menu with cursor keys or the first letter of the menu choice.*

Javelin Plus includes more than 100 financial, math, date, and other functions to help you analyze data. Many functions, such as SUM(), MIN(), MAX(), NPV(), IF(), and LEFT(), are implemented much the same as in *1-2-3*. Other functions, such as QDAYS(), take advantage of *Javelin Plus*'s built-in time periods and return useful calendar information for calculations. In addition, there are powerful statistical functions for trend analysis and financial functions for depreciation calculations.

Once you've entered variables, constants, and tables, you again use different views to analyze the information and prepare it for presentation. Javelin has done a lot to promote an awareness of errors in spreadsheets. The Errors View looks just like the Formulas View, except that it shows only the formulas that have errors or are undefined. You can add and edit formulas in this view just as you can in the Formulas View.

You can create many schedules and spreadsheets in the Worksheet View when a row-and-column orientation is needed. The Chart View gives you a simple bar chart, while the Quick Graph and Graph Views use the entire screen to display your data graphically; Quick Graph clears the screen to graph a variable. You can use your cursor to change the data, but what you see is what you get.

The Graph View lets you choose among nine different graph types, including mixed bar and line, pie chart, and *x-y* scatter plot. You can plot as many as

can print directly from within the program, and you can choose how big graphs should be and where they should appear on the page. All in all, *Quattro*'s graphic output doesn't fall too short of what you get in some standalone graphing programs.

COLOR COMBINATIONS You will find the same attention to appearance throughout the program. You can astound users of the perennially drab *1-2-3* by changing the colors of just about every part of *Quattro*. You can also use color to convey useful information, so that you can tell at a glance which numbers are above or below a certain threshold. And in a subtle, useful touch, *Quattro* distinguishes between labels and numbers by displaying them in slightly different hues.

As is now standard in post-*1-2-3* spreadsheets, you can create a macro script by recording keystrokes. What's more, this script will run accurately no matter how much you customize the command menus. This is because *Quattro*'s recorded macro script is a series of command words rather than simple keystrokes. Thus, the recorded script for a macro that deletes a column would be {/Column Delete} rather than a cryptic series of letters. When you run the macro, *Quattro* processes this script as "command equivalents" rather than as keystrokes, thus ensuring that the

seven variables and enter legends, titles, subtitles, and *x* and *y* axis titles. It's simple to change the settings, but to control the colors your plotter uses, you have to assign variables to match the colors *Javelin Plus* assigns.

Operations such as printing or saving a model are done through a pull-down menu system that is common to all views. As in *1-2-3*, the Slash key activates a menu bar, and you can select your choice with cursor keys or the first letter of the command. You next select a submenu choice from the pull-down menu. The menu choices include Define and Clear, which sets the defaults for and clears variables, time periods, worksheets, and other items. With View and Window you can change the contents and characteristics of the screen, while Print and File control the output, saving, and retrieving of a file. In some cases a view (such as Worksheet or Formula) has a special menu bar with a function relating only to that view.

Much as in *1-2-3*, you can create macros to do repetitive tasks in your model. To define a macro, you set up a Macro View, give it a name, turn on keystroke recording, enter the commands, and turn off the recording. *Javelin Plus* substitutes its own commands, such as @LEFT for the left cursor and @F9 for *calculate*, the function of the F9 key. You can then modify the macro by adding user prompts, labels to jump to, conditional expressions, and commands to create custom menus. As in *1-2-3*, a macro with a one-letter name can be executed with the Alt key and the letter. For larger names, the F7 key plus the name will execute the macro.

Just as *1-2-3* accepts add-in products, *Javelin Plus* can be enhanced with snap-in building blocks. *Javelin Plus* includes several built-in building blocks, such as data import and table lookup, that contain preprogrammed routines to perform functions that would be difficult to create in *Javelin Plus*. To use the building blocks, you connect input variables to them and define the variables that will receive the output. When the building block is invoked, *Javelin Plus* will process the data for you and fill the output variables.

Javelin Plus's documentation includes an installation guide, a learning guide, a reference and quick-reference manual, and a description of the snap-in building blocks. The learning guide covers the basics, and there are further case studies if you need more practice. The reference manual is fairly detailed in its descriptions and contains many diagrams and examples of *Javelin Plus*'s features. If you need technical support, you can call Javelin free within 30 days after your first phone call, or you can buy one of Javelin's support plans.

If you are interested in *Javelin Plus*, there are a few things to consider. A minimum of 512K of memory is recommended, so you may need some EMS memory if you create hefty models. Much as in *1-2-3*, the database function is forced into a worksheet format, and it isn't the easiest feature to use. Many of the built-in functions are powerful yet more complicated than those of *1-2-3*, so expect to spend more learning time to get up to speed.

If you like your good ol' spreadsheet with rows and columns, *Javelin Plus* is not the package for you. Nonetheless, with its multiple views, variable orientation, and powerful time-based capabilities, *Javelin Plus* offers some unique advantages over the typical spreadsheet for the serious business model builder.

—Mike Falkner

PC MAGAZINE FACT FILE



***Javelin Plus*, Version 2.01**
Javelin Software Corp.
One Kendall Sq.
Bldg. 200
Cambridge, MA
02139
(617) 494-1400
(617) 494-0400 for client service
List Price: $395
Requires: 512K RAM, two disk drives (hard disk recommended); DOS 2.1 or later. Graphics monitor recommended.
In Short: A powerful analysis tool that uses English-language formulas, constants, and time-based variables. *Javelin Plus*'s sophisticated screen displays facilitate the entry and reporting of information. Not copy protected.

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macro executes properly, no matter how concentrically you customize the menus.

When you write macro script directly, you can choose to write it as keystrokes or as command equivalents. And if you forget the name of a particular operation, you can hit Shift-F3 to get a list of command names, which you can copy directly into your script. But even more important, you can have as many macros as you like and give them real names, rather than the single-letter names that *1-2-3* restricts you to. F8 gives you a menu of all defined macros, and you can choose which one you want to run. If you like using the traditional Alt-letter combination for running macros, you can use that too.

DEBUGGING Finally, *Quattro* has the best macro debugger of any spreadsheet I have seen. Borland has recognized that macro script is a real language that deserves real programming tools. When you run a macro in single-step mode, *Quattro* displays the executing macro in a window at the bottom of the screen. You see three lines of code, with their cell addresses, as the cursor highlights the currently executing command. At any point, you can switch to full-speed mode.

A simple way to use the debugger is to set breakpoints. You can designate up to four points in the macro where execution

will stop, and you can then inspect temporary results. You can even set the "pass count" so that if you are testing a loop, the macro will pause every 5 or 50 loops. However, I found that this pass count feature doesn't always work reliably.

More interesting are conditional breakpoints, which stop the macro when certain conditions are met. This lets you figure out exactly at what point in the macro certain unplanned events are taking place. Finally, you can establish up to four "trace" cells. The macro debugger will display the values of these cells as the macro executes. This type of display is essential if macros affect parts of the spreadsheet that won't all fit on-screen together. The trace display updates only when you stop the macro, not in real time, but is still very useful. Taken together, these debugging tools will save programmers hours of work.

Quattro's recalculation speed has been touted as one of its great advantages over *1-2-3*, but whether it beats *1-2-3* depends on the structure of your calculations. *Quattro* uses minimal recalc, which means it doesn't recalculate every formula in your worksheet. Instead, it tries to limit recalculation to only those formulas that are affected by your latest changes. However, it takes some time to figure out how a change affects the different formulas in a spreadsheet and to figure out which ones have to be recalculated. If it turns out that they all have to be recalculated, then the time you spend doing the figuring is wasted.

Thus, if you have a model that must completely recalculate whenever you change the data, *Quattro* will probably be slower than *1-2-3*, sometimes much slower. It is possible to devise admittedly peculiar operations that *Quattro* takes *20 times* longer to do than *1-2-3* does. However, if changing data means that only a few formulas out of many must recalc, then *Quattro* could be many times faster than *1-2-3*.

NOT FULLY COMPATIBLE People have bought *Quattro* on the understanding that it is fully *1-2-3* compatible. It isn't. When you load certain *1-2-3* files, *Quattro* may display an undocumented error message. This happens to be harmless, but it's still unnerving. More seriously, certain string arithmetic functions will not display properly in *Quattro*, and any macro that depends on them will crash. *Quattro* does not always trap errors in the same way that *1-2-3* does, and the @RAND function behaves differently in the two programs. Even worse, and more mysteriously, it is possible to write legal *1-2-3* macros that not only fail in *Quattro* but hang the system. Finally, you can stuff *Quattro* so full it won't accept one more character, yet its memory status indicator insists that you have more than 5K RAM available.

Plenty of people have used *Quattro* for months and not had problems, but if my business depended on sophisticated *1-2-3* templates, I would be leery of using it as a replacement for *1-2-3*. If you don't need strict compatibility, *Quattro* offers a lot of features at a low price.

Surpass

Surpass ($495) is one of the most elegantly powerful spreadsheets designed for the *1-2-3* user base. It combines scrupulous compatibility with a host of excellent features that make it a joy to use. It offers many of the benefits promised in Release 3.0 of *1-2-3*—macro libraries, string search, undo, spreadsheet linking, networking—and you can buy it today.

It is *Surpass*'s adroit handling of multiple spreadsheets that sets it apart from every other *1-2-3* compatible. It can hold as many as 32 different spreadsheets in memory at the same time and display each one in a separate window. You can move and resize windows at will and jump quickly from one spreadsheet to another. If you have an EGA card, you can configure *Surpass* to come up in 43-line mode so you can *see* all these spreadsheets. And if you have that many cells on-screen, you'll be especially grateful that *Surpass* highlights the column number and row letter along the borders as you move the cursor: you can see the cell address of the cursor at a glance.

LINKING SPREADSHEETS But most important, formulas in one spreadsheet can be linked dynamically, or "Hot Linked" (the term "Hot Link" is a trademark of Surpass Software) to cells in as many as 32 other spreadsheets. This is the consolidation feature that *1-2-3* users have been craving. And since you can refer to spreadsheets on-disk, your models aren't limited by RAM but only by the size of your hard disk.

It couldn't be easier to link spreadsheets. If you want a formula to refer to a cell in a spreadsheet named WEST, you just put the name in square brackets in front of the cell address. [west]B15+C25 is a formula that adds the value of B15 from WEST to the value of C25 in the current worksheet. @sum([west]TOTAL)*[ratios]RETURNS would add the cells in the TOTAL range of the WEST worksheet and multiply the sum by the value in the RETURNS range of the RATIOS worksheet. Hot-Linked cell addresses can be absolute, relative, or mixed. When you copy them within the current worksheet, they pick up the absolute or relative values from the external spreadsheet, which is exactly what you expect. You can even Hot-Link out to *1-2-3* spreadsheets, but if you have a *Surpass* model in *1-2-3* format, it will break its Hot Links.

There are a few tricky things about Hot Links. If you update a cell that another spreadsheet refers to and that spreadsheet is on-disk, *Surpass* won't go out to disk and update that model with the Hot Link. The next time you read it from disk, though, *Surpass* will prompt you for Hot-Link updates, and if you say yes, all the references will quickly recalculate. However, updates aren't foolproof. If spreadsheet C depends on spreadsheet B, which depends on spreadsheet A, a change in A won't be reflected in B or C if they are out

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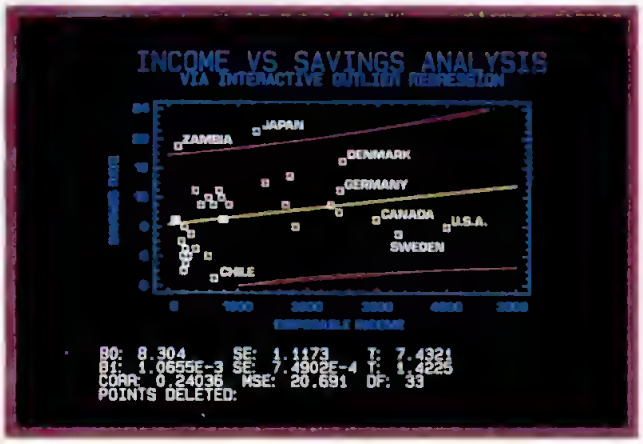
***Surpass*, Version 1.01**
Surpass Software Systems, Inc.
250 Bel Marin Keys Blvd.
Novato, CA 94949
(800) 338-5452
(415) 382-8840

List Price: $495
Requires: 512K RAM, hard disk drive, DOS 2.1 or later.
In Short: A potent, well-designed superset of *Lotus 1-2-3* that lets you link multiple spreadsheets. Not copy protected.

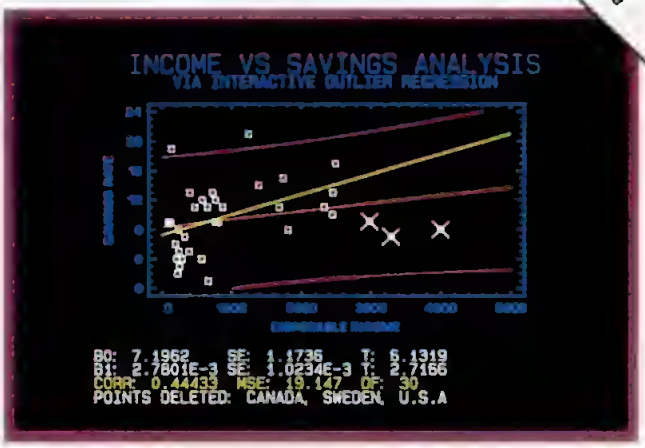
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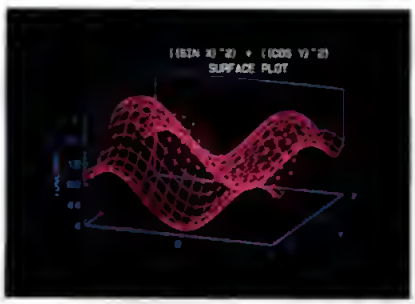
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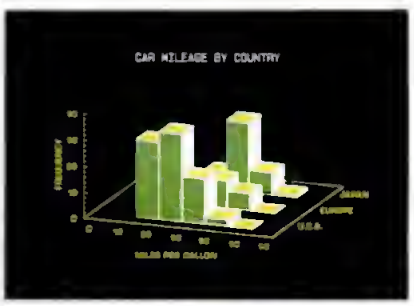
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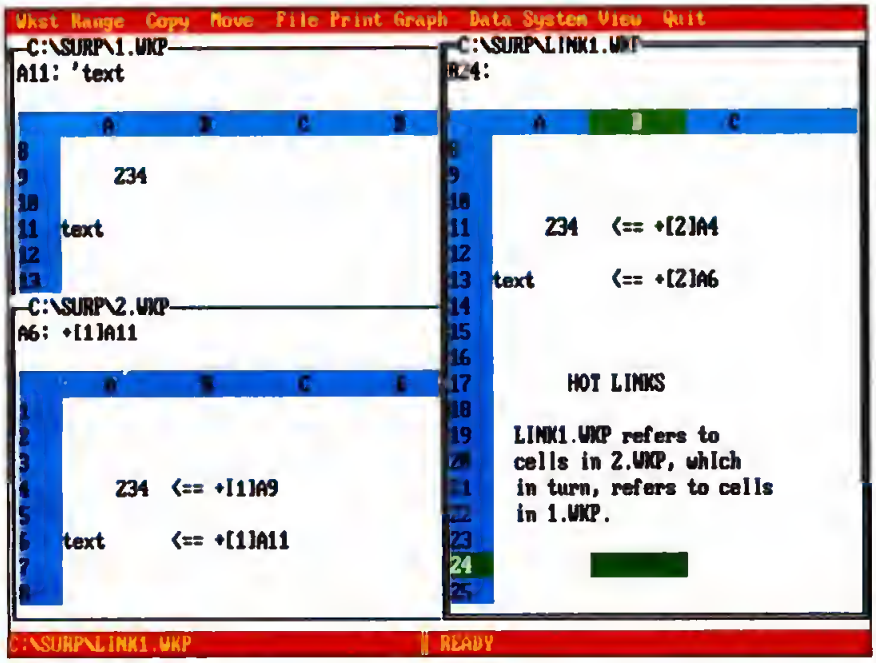
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Three Surpass *spreadsheets are opened in memory at the same time. There is a daisy chain to Hot Links, with all values on-screen ultimately dependent on cells in the spreadsheet 1.WKP.*

on-disk. If you load C and update Hot Links, C still won't reflect the changes you made in A unless you updated B first. This sounds more involved than it is; with a little care, Hot Links work like a charm.

Hot Links aren't the only reason to buy *Surpass*. Its undo feature means you won't have to play for keeps. If you hit Backspace at the Ready state, *Surpass* will undo the previous command. Hit Backspace again and it will redo the command. *Surpass* also has an excellent search (but not replace) command that lets you hunt for values, strings, or labels. A search can be case-sensitive or -insensitive, and you can even search conditionally: for example, *Surpass* will find every cell with a value of less than 350.

Surpass has also taken much of the pain out of recalculation: it recalcs only the formulas that have changed since the last recalc, rather than recalculating every cell. Also, if you turn on background recalc, it will politely stop doing arithmetic whenever you hit the keyboard. This way, you can carry on with your work, and recalc will start up again whenever you pause. This is a lovely feature except for those times when you can't move a muscle until you've seen the results of every single calculation.

BETTER GRAPHS *Surpass*'s graphs are also a big improvement over what you get in *1-2-3*. You can show pies, columns, and stack bars in 3-D—and choose the colors. There is no arbitrary limit on the number of data points you can plot, so the only limits are system memory and screen resolution. You can print directly from the screen without fiddling with a special print utility, and you can vary the size and position of what goes on paper. *Surpass* even has enough sense to spool the print job to disk and hand the computer back to you while your printer does its work. And if you like, you can string graphs together as a slide show.

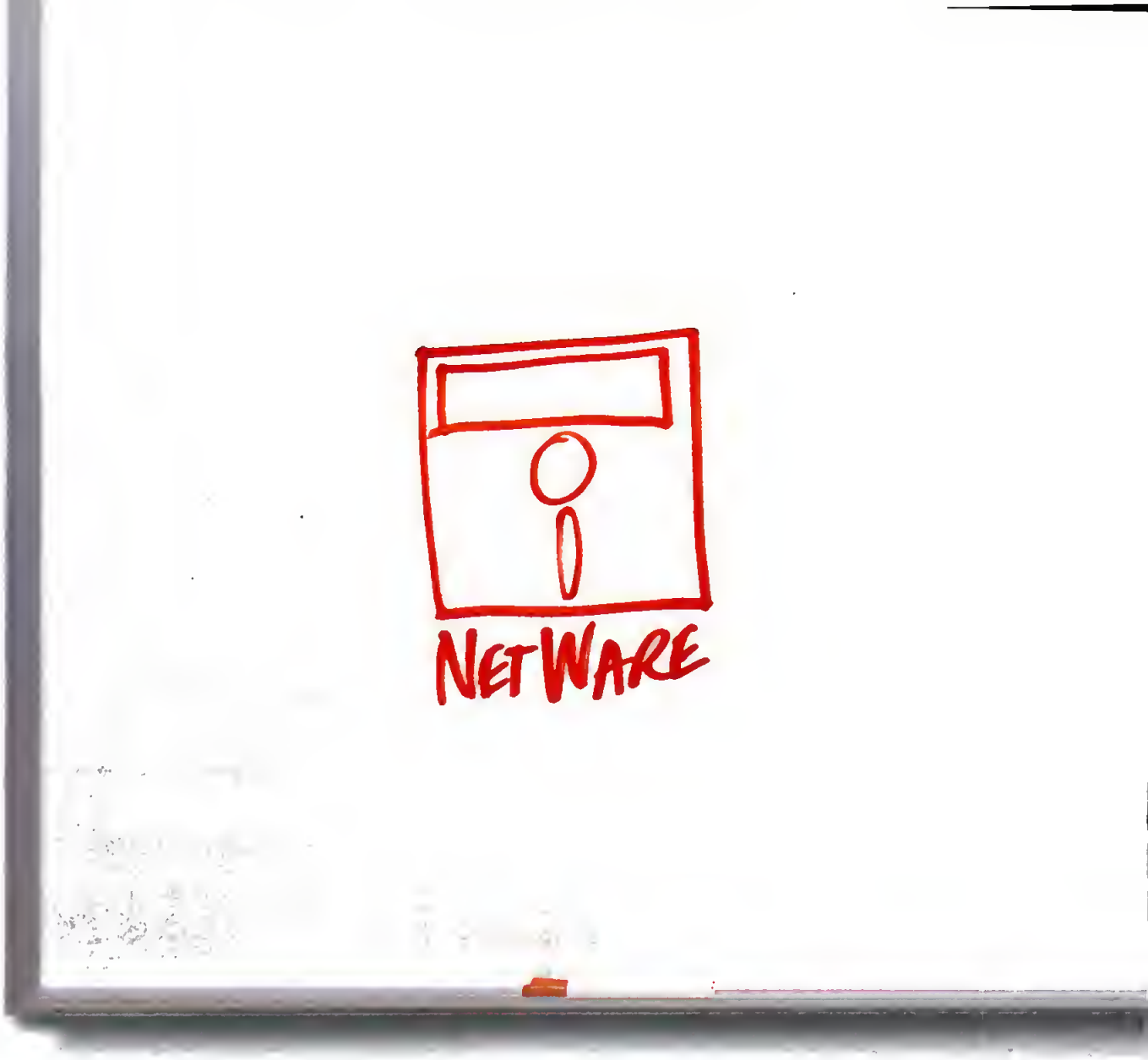
INDEPENDENT MACROS Like all serious *1-2-3* competitors, *Surpass* lets you record simple macros by running procedures from the keyboard. Better still, *Surpass* lets you store macros in any spreadsheet you designate as a macro library. This way, when you hit an Alt-letter combination to run a macro, *Surpass* first looks for the macro in the current worksheet. If it doesn't find one there, it looks in any spreadsheet in memory that you have designated as a macro library.

This means you can finally write macros that are independent of specific spreadsheets. If you have a set of utility macros, for example, you can keep them in their own separate library and load them whenever you need them. You can also write macros that operate on many spreadsheets in sequence, since macros can load and save files without kicking themselves out of memory.

It can be a great advantage to separate data and code this way, but there can be advantages in mixing them. Even when library macros are operating on some other spreadsheet, they generally branch to subroutines located in the library spreadsheet. However, you can easily write branch instructions to make the macro branch to a subroutine *in whatever spreadsheet that macro is operating on*. This way, a macro that you store in a separate library can selectively use routines that are specific to whatever spreadsheet it is operating in. This greatly expands the power of macro libraries.

The macro language also has special keywords to run the *Surpass* commands not found in *1-2-3*. Keywords such as {zoom} and {resize}, for example, handle windowing operations, and {findnext} operates the string search command. Another interesting keyword is {graphchar}, which lets you use graphs as menus. When a macro sequence shows a graph and pauses, this command accepts keyboard

■ Most important with *Surpass*, formulas in one spreadsheet can be linked dynamically to cells in as many as 32 other spreadsheets.



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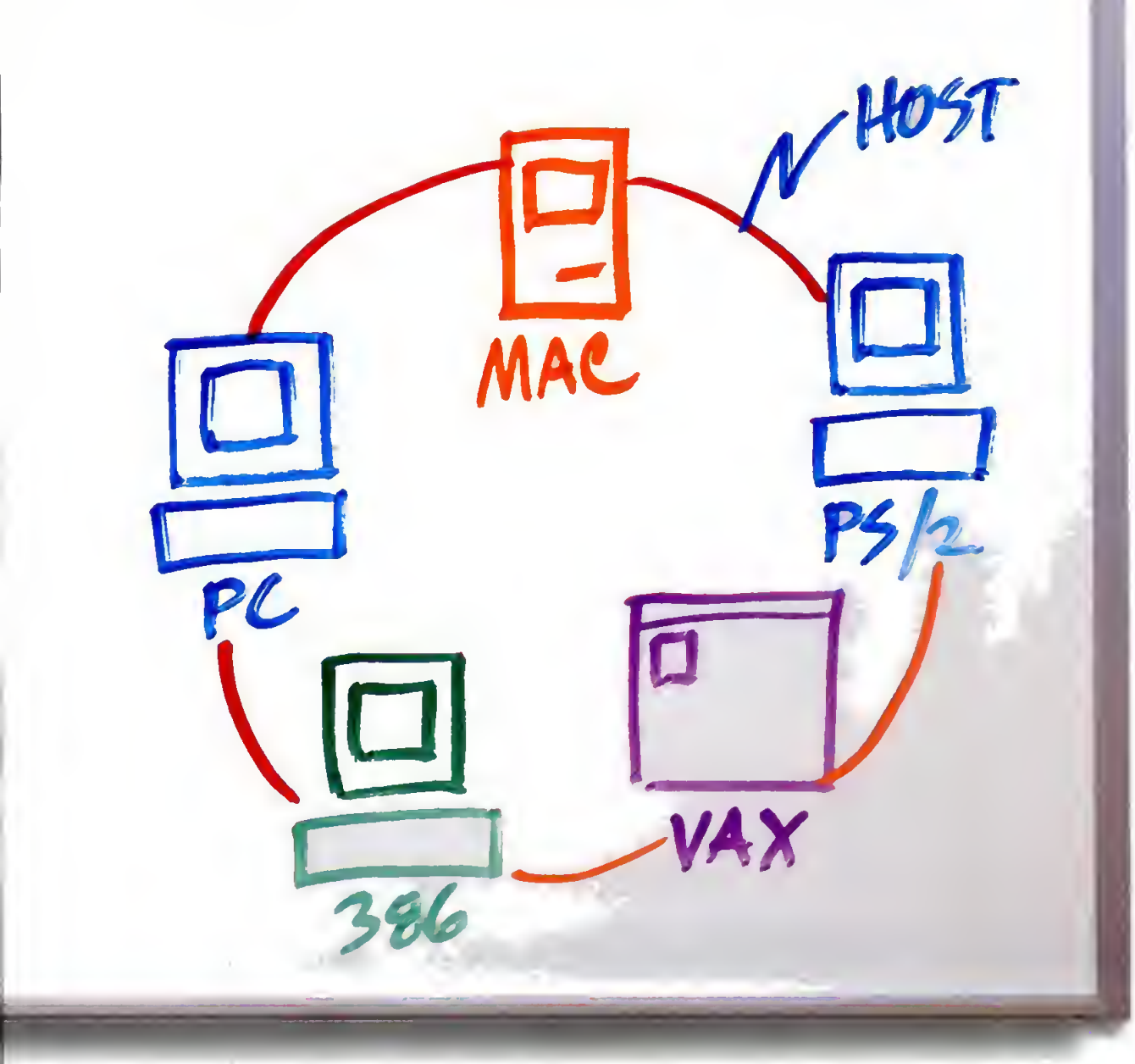
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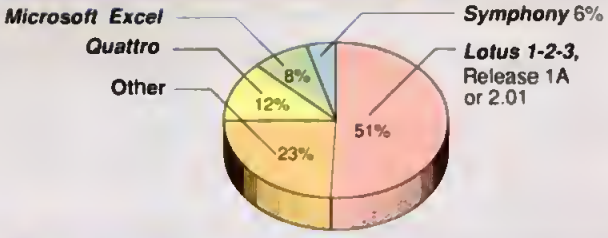
For network solutions, you should be seeing red.

CIRCLE 103 ON READER SERVICE CARD

PC MAGAZINE Spreadsheet Survey

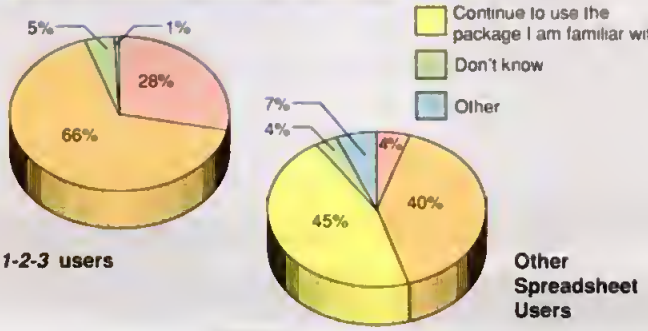
With the continuing delays in *Lotus 1-2-3*, Release 3.0, the competition is fierce in the spreadsheet software industry. When we surveyed readers who influence the choice of which spreadsheet is bought in their office, we found that although *1-2-3* continues to dominate the market, non–*1-2-3* users are loyal to their spreadsheets. Their interest in Release 3.0 is cool at best.

Which spreadsheet do you use?



Lotus still has more than half the market, but its dominance is less overpowering. According to our reader survey, 57 percent use *1-2-3* or *Symphony* (Lotus once had more than an 80 percent share). In the past year, Borland's *Quattro* and *Microsoft Excel* have gained shares of 12 and 8 percent, respectively. Among the *1-2-3* users, more than 90 percent use Release 2.01.

If *Lotus 1-2-3*, Release 3.0, were available tomorrow, what course of action would you take?



Among the *1-2-3* users, 94 percent replied that they would upgrade to or at least evaluate Release 3.0. This contrasts sharply with non–*1-2-3* users' response: more than 45 percent indicated they would continue to use their current software.

input and branches accordingly. The user could therefore choose which graph to look at next or whether to go on to something else.

Finally, *Surpass* has an improved step mode for macro debugging. As the macro executes in slow motion, *Surpass* displays the current line of macro code and highlights the current command. This way, you can find out exactly at what point things are going wrong.

DOS SHELL This whole powerful package is wrapped inside a DOS shell that *Surpass* calls the visual file manager. For people who actually like DOS, it's annoying at first to be forced to use the shell just to get into the program, but it's a pretty good shell. It can draw a picture of your directories and move, copy, and delete files. It can also do negative filters; for example, you could have it display all .WK1 files that *don't* begin with T. The shell will be a boon to most and a tolerable curiosity to the rest.

Although all commands, in the shell and the program, are available through menus, *Surpass* uses function keys and Ctrl-shifted character keys as shortcuts. These are a big help once you learn the program and almost make up for the fact that *Surpass* has no mouse interface.

Though I didn't test the program on a network, the company claims that *Surpass* was built from the beginning to be networked. Any copy can run on a network, and for $2,000 you can get a version that serves up to ten workstations. You can Hot Link to any spreadsheet on the network, which makes for really distributed spreadsheet operation. You can also use the DOS shell to find any file on the network.

There's so little to dislike about *Surpass* that it's almost embarrassing. I found only a few things: It doesn't let you drop out to DOS and return to an intact spreadsheet as other programs do. When the spreadsheet is empty, it leaves you about 104K less memory for models than *1-2-3* does, which could be important if you don't have EMS. Also, if you try to run it without enough memory, *Surpass* sometimes tries to load anyway. You have to do a warm boot and start over. And although *Surpass* has good on-line help, the manual makes only a sad stab at an index. Finally, for a market that is used to discount pricing for "clones" no matter how much better than *1-2-3*, *Surpass* is overpriced.

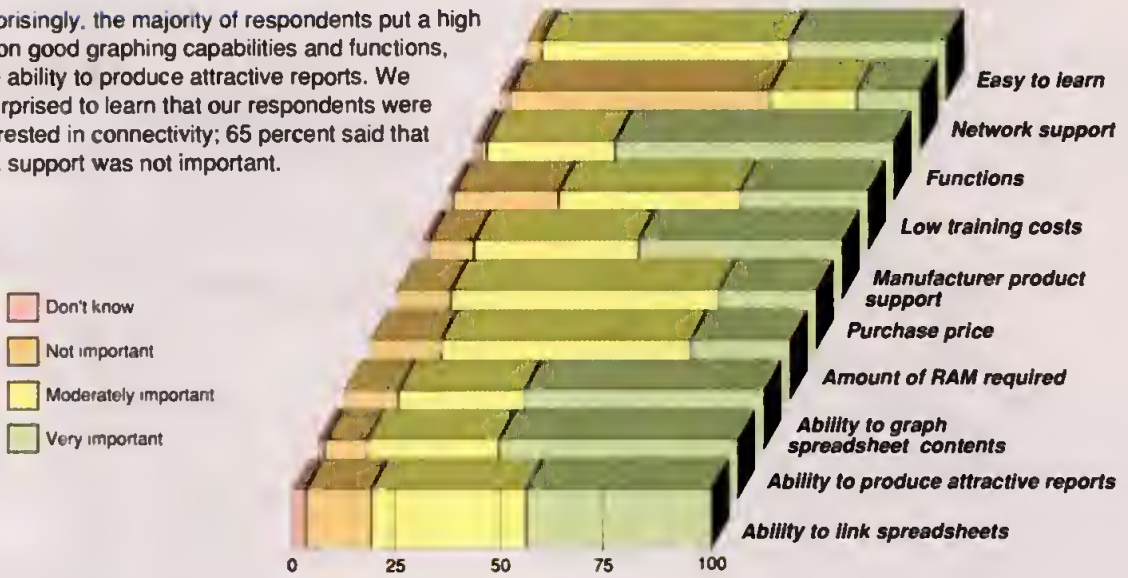
But that's about it for complaints. *Surpass* is a great product that can hold its own as a corporate standard just about anywhere.

VP-Planner Plus

VP-Planner ($249) is generally thought of as a low-priced *1-2-3* clone, but this assessment understates its real scope by approximately one half. Yes, it is a spreadsheet with a number of significant additions to the *1-2-3* standard. But this respectable spreadsheet is also the front end to a respectable database, and it allows direct access to *dBASE* files. There's a lot to *VP-Planner Plus*, Version 2.0, and if you need to do the things it does, it's a bargain.

Please rate the importance of the following features:

Not surprisingly, the majority of respondents put a high priority on good graphing capabilities and functions, plus the ability to produce attractive reports. We were surprised to learn that our respondents were not interested in connectivity; 65 percent said that network support was not important.



Of all the improvements *VPP* has made to *1-2-3*, undo/redo and text editing are probably the most important. Undo/redo is a vast improvement over simple undos that let you take back only your most recent command. It lets you step backward—and then forward—through a whole series of commands. It does this by saving commands and spreadsheet status in a buffer. Eventually you will run out of space in the buffer, so you can make it as big as 64K. However, you have to take this memory away from your workspace, and 16K will do for most purposes. You can even back up after a /Worksheet Erase Yes command, since the undo feature cleverly holds the "erased" worksheet in memory rather than trying to store it in the buffer. This is a sophisticated, powerful feature that makes it easier than ever to back up after "what-if" experiments.

GOOD TEXT EDITING *VPP*'s text-editing tools are a welcome concession to the fact that many people use their spreadsheets as simple word processors anyway. With word wrap, string searches, centering, and simple block moves and copies, you'll feel perfectly comfortable knocking out business letters from inside your spreadsheet. This mini-word-processor can read and write ASCII files, but its print capabilities are no better than the ones used to print spreadsheets.

Though it doesn't have intelligent recalc—*VPP* recalculates every formula rather than only the ones that have changed—it makes up for it with background recalc. If *VPP* is grinding through a big worksheet, you can step in and interrupt it if you need to work on your model. *VPP*'s background recalc is also "intelligent" in that it first does the calculations necessary to put correct values in cells in the current screen. If these cells depend on formulas in distant parts of the worksheet, *VPP* does those calculations first. Only after the current screen is correct will it go off and calculate everything else.

This means that most of the time, *VPP*'s recalc speed is irrelevant because all the values you can see update quickly, and because you can interrupt the remaining background calculations if you need to work on your model. There's a catch, though. If you're in manual mode and you try to do even a simple, single-cell calculation *while background recalc is still going on*, recalculation suddenly leaps into the

PC MAGAZINE **FACT FILE**

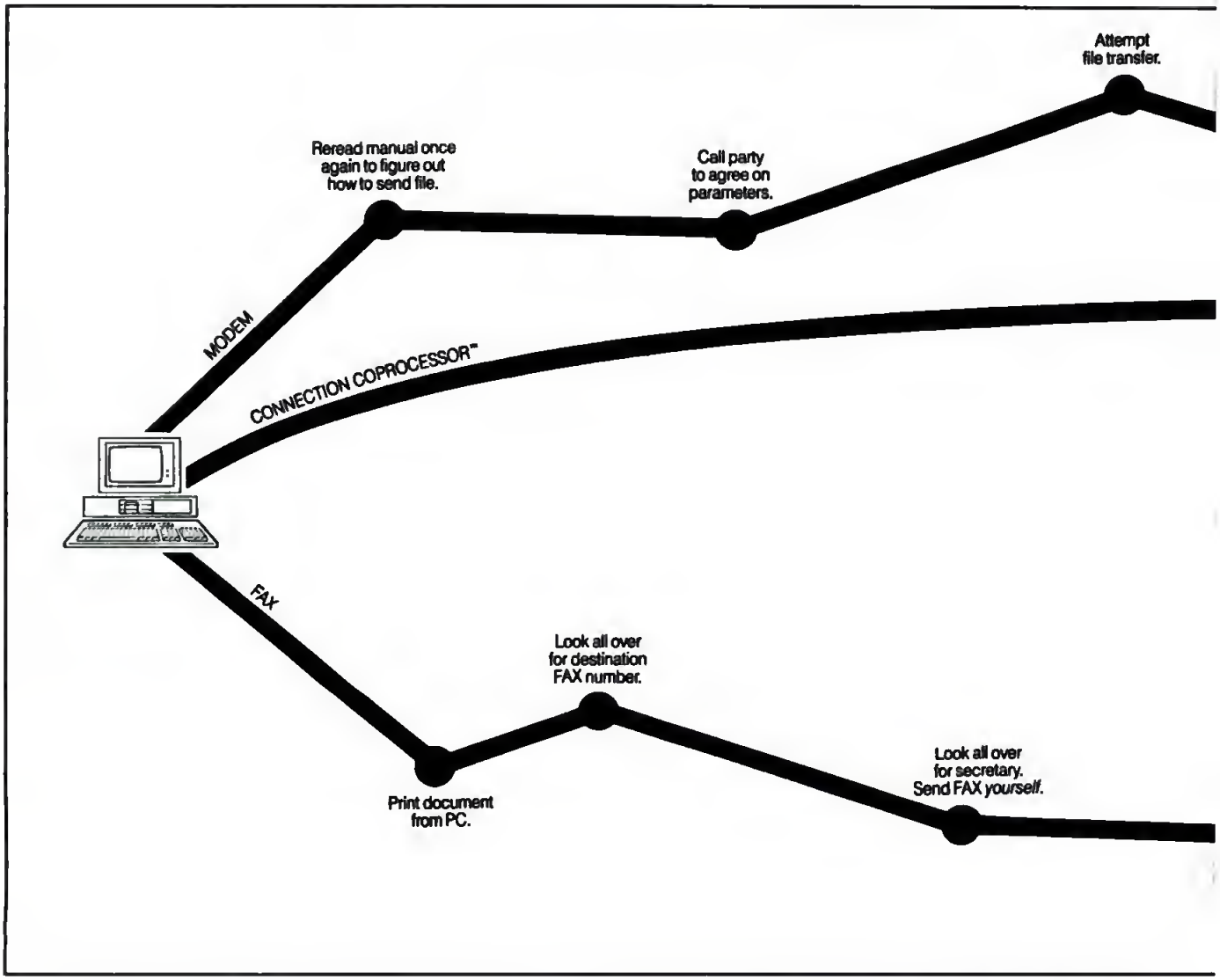


***VP-Planner Plus*, Version 2.0**
Paperback Software International
2830 9th St.
Berkeley, CA 94710
(415) 644-2116
List Price: $249

Requires: 384K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
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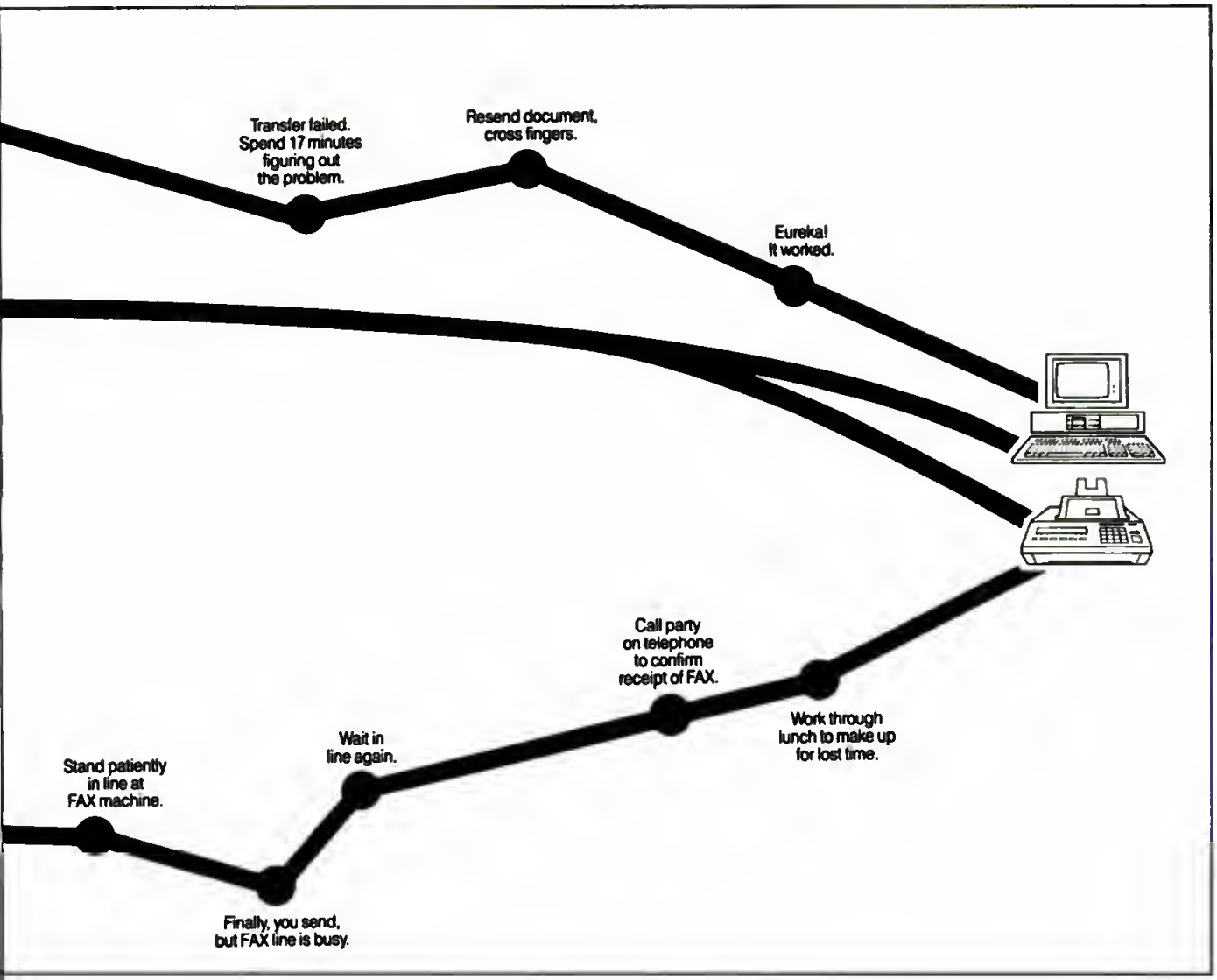


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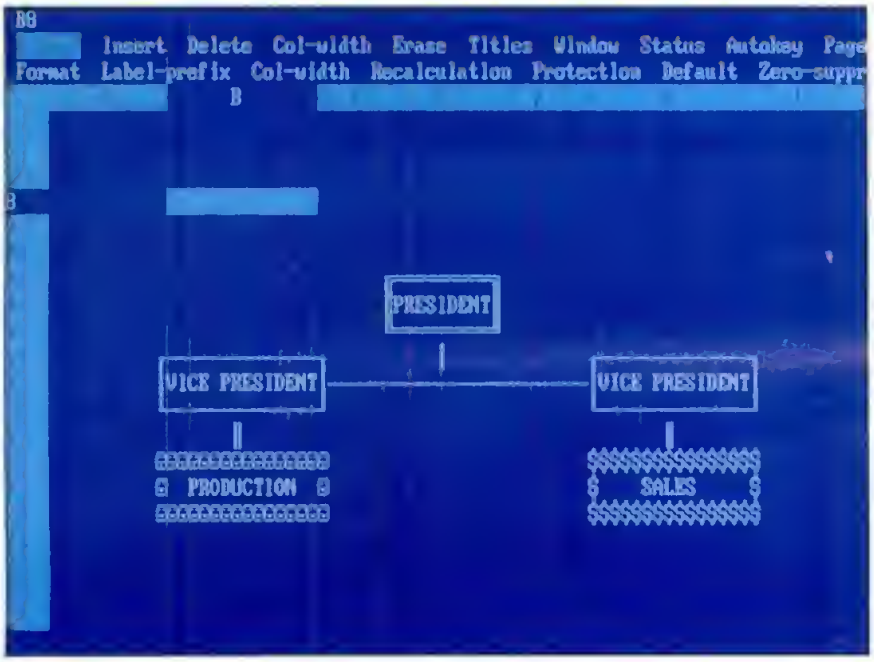
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CIRCLE 297 ON READER SERVICE CARD



VP-Planner Plus *is shown with 1-2-3–style menus instead of pop-down menus. The program's drawing tools were used to produce the image on-screen.*

foreground. The program locks up, just like *1-2-3*, and gives you a flashing WAIT message until the whole spreadsheet finishes recalculating. That may be the only time you'll feel it, but *VPP*'s actual calculation speed is slow—sometimes as much as three times slower than *1-2-3*'s.

VPP's appearance is closely modeled on that of *1-2-3*, but with some obvious differences. Pop-down command menus, for example, give you more information about options, but they sometimes cover up data in your worksheet. If you need to peek at what's under the menus, the Shift or Ctrl key will temporarily make the menus go away without losing your place in the menu tree. Or if you don't like pop-down menus at all, you can configure *VPP* with two-line menus, as in *1-2-3*, with the choice of putting them either at the top or bottom of the screen.

You can also change the colors of *VPP*, though not with as much flexibility as you can those of the other *1-2-3* compatibles. If you can't remember what the function keys do, you can keep a function-key menu on the screen, though to *1-2-3* users it looks a little cluttered. An unqualifiedly nice touch, though, is the pop-up menu for Alt-shifted function keys. Whenever you hit Alt at the Ready state, you get a very handy menu of what the function keys will now do.

Though *VPP* can't use contrasting colors to highlight values above or below certain limits, it is otherwise quite good at data display. Besides additional @ functions like @monthname and @dayname, you get handy custom formats. For example, besides displaying foreign currencies with or without commas and periods, you can set up unusual formats for special jobs. For example, you could invent a format that displayed the numbers 12345 as Part #12-345.

USING MACROS Like most current spreadsheets, *VPP* lets you record macros from the keyboard, though such macros can contain no more than 512 characters. As you record, you can tell how many characters you have left by watching a box that counts down to zero. It's easy to convert these recorded macros to regular script if you decide to expand them or use them as routines in longer macros.

One convenient advance over *1-2-3*'s macro language is more custom menu choices. You can have even more than will fit on the screen; the user can cursor out to them if necessary. And though *VPP* does not have *Quattro*'s excellent macro debugger, it conveniently lets you set points in a macro that slow down operation to single step. You can resume full-speed execution from the keyboard at any time. Besides automating usual spreadsheet functions, *VPP*'s macro language gives you control over the program's database features as well.

VPP has another macro-related tool called Transcript. This lets you record keyboard script of unlimited length to a disk file. If you have a power loss, you can reconstruct a spreadsheet by replaying the script. Since you can run disk-based scripts from within any spreadsheet, they can also act as macro libraries. However, since these scripts may contain only keyboard input, macro libraries can't contain complex program macros.

VPP has taken pains to keep its macro language as *1-2-3* compatible as possible. Here and there it has departed from Lotus standards, but often in ways that are helpful. For example, *VPP* recalculates automatically after {getnumber} and {getlabel} commands rather than requiring a deliberate recalc. *1-2-3* macros generally operate correctly, but very complicated ones sometimes crash. I would think twice about the program if I planned to use a lot of tricky *1-2-3* templates.

■ You'll feel perfectly comfortable knocking out letters from inside your *VPP* spreadsheet.

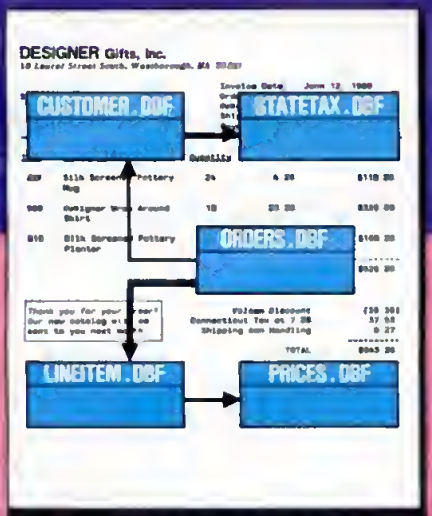
PRINTING AND GRAPHICS *VPP*'s printer controls are a mixed blessing. You can print sideways and in background, but only if you have the printers that *VPP* expects. *VPP* has no printer installation routines and essentially expects you to use an

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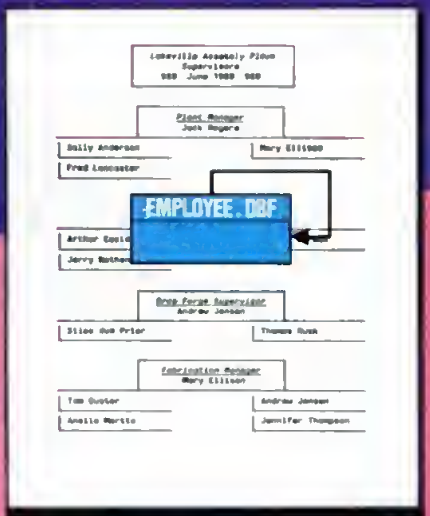
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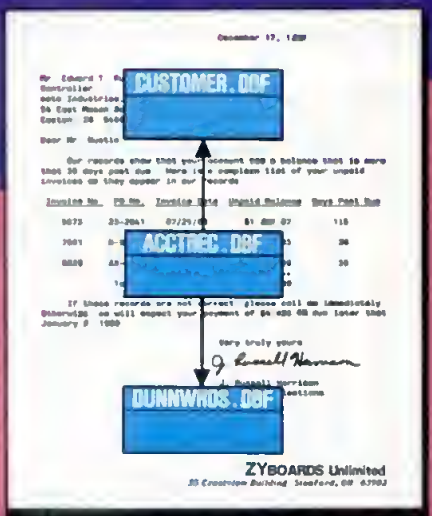
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CIRCLE 315 ON READER SERVICE CARD

PC EDITOR'S CHOICE

- Microsoft Excel
- Surpass

In our issue of October 27, 1987, we did a roundup like this one of spreadsheets that we thought were a real match for 1-2-3. *In our wisdom and our bliss, we awarded the Editor's Choice to a slick* 1-2-3 *compatible called* Silk. *The vendor, Daybreak Technologies, promptly slipped from sight, maintaining only limited research and development. Recently, Daybreak Technologies got a new round of financing and has put a new version of* Silk *on the market.*

Undaunted, this time we have awarded an Editor's Choice to a product whose company has, in effect, already gone out of business (see introduction). Although Surpass Software Systems will continue to sell the current version of Surpass *for as long as there is demand,* Surpass *users will upgrade along the Borland path. The future of* Surpass *resides with Borland.*

Surpass *is a smoothly powerful extension of* 1-2-3 *in what we think are exactly the right directions.*

Genuinely useful spreadsheet links, good graphics, fast recalculation, and macro libraries, along with rigorous 1-2-3 *compatibility, make this the most convincing addition to the Lotus standard we have yet to see. And hats off to Borland for recognizing the merits of a competitor and saving it from oblivion.*

Two Editor's Choices out of a field of four may seem overly generous, but we are just as taken with Microsoft Excel*'s daring departure from the* 1-2-3 *standard as by* Surpass*'s improvements to it. Even for grizzled old spreadsheet veterans, the* Excel *interface is just plain fun to use. On-screen formatting and printing are so flexible that they're practically yogic. Auditing tools, print previewing, a potent macro language, DDE, and frequent* 1-2-3 *compatibility all add up to a package that points the direction in which spreadsheets are going.*

You can Surpass *or you can* Excel; *either way, you're better off than you were before.*

IBM-compatible graphics printer—my laser printer went crazy when I tried to print a graph. *VPP*'s graphs are considerably better than *1-2-3*'s, and you can print them from the screen, but the program's graphics don't try to go all out the way those of other *1-2-3* compatibles do.

Still, *VPP*'s spreadsheet has many excellent features. One is line and box drawing. You can draw with single lines, double lines, or any character you like, to build organization charts or simply to highlight data. Equally handy is optional auto-save, which lets you set intervals—from 1 minute to an hour and a half—at which *VPP* automatically saves your work. *VPP*'s F5 key works as a normal Goto, but also lets you enter string searches. If you enter a label prefix and a string at the Goto prompt, *VPP* searches all labels below and to the right for that string. Hit F5 twice to search for the next occurrence. Finally, if you need to set widths for a range of columns, *VPP* gives you a single command for doing them all at a clip.

DOUBLING AS A DATABASE Besides all this, though, *VPP* offers you real data control. Unlike other spreadsheets that make you keep all your data in memory, *VPP* lets you build databases as big as your hard disk. The most straightforward way to use *VPP* to handle serious data is as a front-end to *dBASE II*, *dBASE III*, or to Paperback Software's database program, *VP-Info*. You can read from or write data to .DBF files by setting up spreadsheet links in special cells. You can run searches using logical (Boolean) and relational operators to get the data you need into the spreadsheet and then manipulate it however you like. Search criteria can be a little tricky to set up, but you can save different criteria in separate cells and use them over and over.

You can do more than simple searches. You can do joins along common fields in different .DBF files and even do joins to data tables constructed entirely within the spreadsheet—as long as they have fields that are common to the .DBF file. Once the data is in *VPP*, you can manipulate it as you like and then write the changes back to the database. All this is possible whether or not you have a database program; *VPP* will use .DBF files created by other programs or build its own from scratch.

You can do even more elaborate operations with *VPP*'s "multidimensional databases," which are built and manipulated without the help of another program. These DIM files, as they are called, can take the place of large numbers of spreadsheets used to present related data from different points of view.

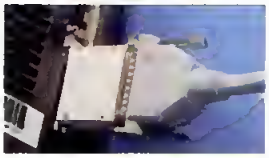
For example, normal spreadsheets display information along two dimensions; a typical example would be monthly profit and loss (P&L) figures over time. However, people often find they need to break out P&L figures by product, by region, by salesman, by customer, or by any number of other "dimensions." Or, if they already have the detailed data, they may need to consolidate it. It takes many, many spreadsheets to convey all this related information, but *VPP*'s "multidimensional" DIM files can hold it all together on-disk in considerably less space. You would access the DIM file in a prescribed way to get consolidated numbers or the particular slice of data you needed.

It takes a lot of prior organization to put together a multidimensional database. *VPP* comes with a special template worksheet to help you organize data along as many as five dimensions, but you'd better have a clear notion of how you want the data structured. You can design in logic along one of the dimensions, say P&L figures, to figure ratios, margins, and other calculations. Along the other dimensions,



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$3.0 billion in sales will be lost to free distribution — better known as software piracy. And right now, Rainbow Technologies' Software Sentinel™ is protecting close to $1.0 billion in software for developers who never wanted to be part of the free software distribution network in the first place. The Software Sentinel hardware key is "execution control" software protection. It ships with the software and simply plugs into the PC's parallel port



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you can simply consolidate by adding and subtracting. Once your data structure is complete, you add or extract information via the spreadsheet. You can automate complex routines with macros.

If your data fits this structure—one that requires consolidation into a whole or disaggregation into details, DIM files can be a powerful and convenient tool. In this version of *VPP*, Paperback Software has tried to simplify the process of setting up and manipulating complex databases, but it's not a job to be taken lightly. The rewards of multidimensionality come at the price of careful design work and a thorough understanding of how the program works. Also, a thorough assessment of database performance would require benchmark testing against comparable programs.

■ Besides automating usual spreadsheet functions, *VPP*'s macro language gives you control over the program's database features as well.

For a simpler but still powerful data structure, you can always access *dBASE* files. If your needs are simpler still, you can build RAM-based, *1-2-3*-style databases, with the added advantage that *VPP* gives you a convenient record-entry form for adding data.

VPP is so data-manipulation-oriented that it could be called a database just as sensibly as a spreadsheet. Because it allows consolidation via DIM files, it makes no attempt to link spreadsheets.

Any user will find that *VPP* is a powerful spreadsheet, but if you need disk-based data control as much as spreadsheet flexibility, *VPP* could be a very effective and inexpensive corporate spreadsheet. PC

Jared Taylor is West Coast editor of PC Magazine. *He edited the Spreadsheet Clinic column for 2 years.*

Almost anyone can use our spreadsheet right out of the box

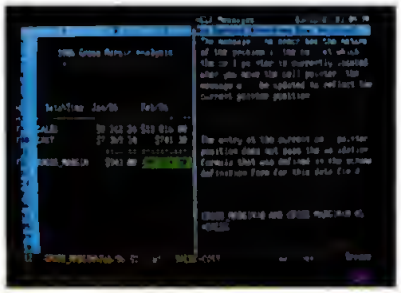
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As you move through each step, you'll see instruction on the right hand side of your screen which guides you and literally teaches as you work.

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Other spreadsheet programs are so difficult to learn that most users master only a fraction of their real potential. Instead, Silk's on-line screen tutor treats you with kid gloves. It will make you a power-user in a few sessions without ever studying the manual.



Beyond 1-2-3

Silk is simple to use but powerful. It maintains the spreadsheet features that made 1-2-3 so popular but adds what 1-2-3 and the others lack.

Silk lets you build formulas as large as 1,000 characters and append each cell with text notes, so you'll always remember what your calculations are based on.

Silk has its own unique screen editor that lets you edit large cell contents—even formulas up to half a screen long. No other spreadsheet can.

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Silk even has a powerful new allocation feature that automatically distributes values proportionately over any number of cells you choose for any reason you wish to cut the pie.



With this feature you can re-allocate increased payroll or a revised financial budget at the touch of a key instead of hours of complex modeling.

You can even keep some cells at a fixed value. Many users find this feature alone is worth the purchase price.

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PC MAGAZINE EDITOR'S CHOICE

"Silk's improved graphics, fine use of function keys, interactive help, global search and replace, and easy-to-arrange worksheet are reason enough to buy... At some point, you have to think about moving onward and upward (from 1-2-3). Silk gives you reason enough."
— PC Magazine

Best of all, you can purchase Silk now directly from Daybreak for only $99 during this special promotion. A real value savings compared to its regular $298.00 retail price.

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Both Silk and Cocoon require an IBM PC or compatible with DOS 2.0 or later. Silk requires at least 512K with a hard disk recommended. Cocoon requires a hard disk.

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- High Performance Dual Hard Drive/Floppy Drive Controller
- Enhanced 101-key AT Style Keyboard
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- Industry Standard BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM EMS hardware drivers
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Small foot print case with 4 Disk Drive bays

Options:

- Full size 5 drive case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Tower Case

Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card				
Video \ Drives	20MB	40MB-40MS	40MB-28MS	80MB-28MS
Mono	$1381	$1485	$1594	$1725
EGA	$1775	$1879	$1988	$2119
VGA	$1946	$2050	$2159	$2290

PC BRAND 286/20 $1400



20 MHz Clock, Zero Wait Operation
Norton SI 20.4 •Landmark™ Speed 25.9MHz
512K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

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- High Performance Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt 5ystem Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
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- 8 Slot motherboard design (6 16Bit & 2 8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Tower Case • 4MB interleaving Ram Card
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD Portable • Factory Installed RAM Upgrades

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286/20 With 512K, Hard Disk Drive, Monitor & Video Card						
Drives \ Video	40MB-40MS	40MB-28MS	80MB-28MS	110MB-28MS 1:1 RLL	150-17MS 1:1 ESDI	320-16MS 1:1 ESDI
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EGA	$2284	$2393	$2524	$2790	$4017	$4417
VGA	$2455	$2564	$2695	$2961	$4188	$4588

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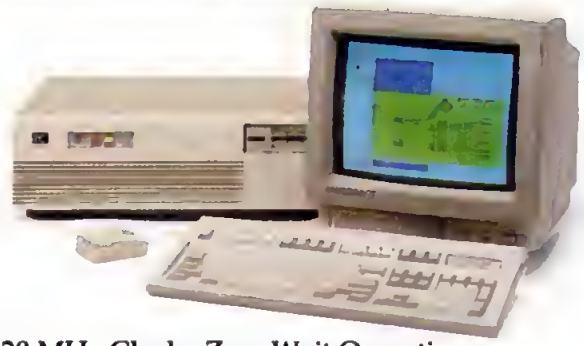
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20 MHz Clock, Zero Wait Operation
Norton SI 24 • Landmark Speed 30MHz
1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

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- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
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VGA	$3505	$3614	$3745	$4011	$5238	$5638

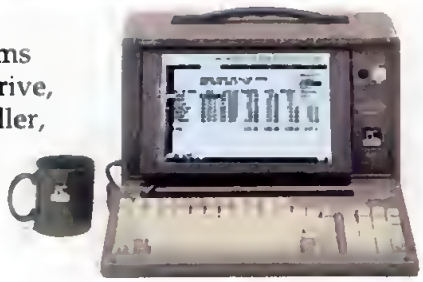
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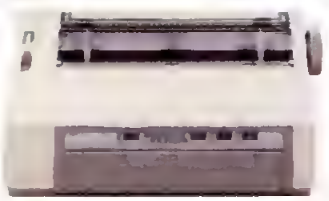
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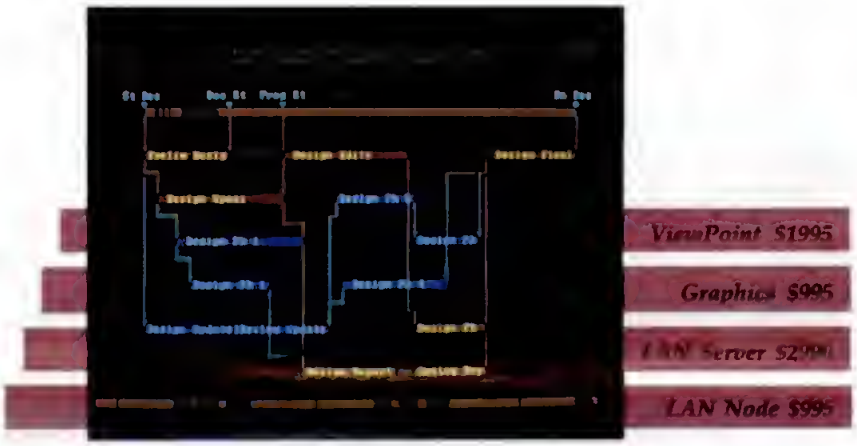
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TRACKING 1,000 TASKS FOR UNDER $600

Having incorporated new tools and planning techniques, low-end project management programs are now easier to use and offer more ways to track and analyze project information.

Project management, as a practice and as a PC application, has had a bad reputation, in part well deserved. To the uninitiated its language and concepts—critical path, work breakdown structure (WBS), resource leveling—can seem as otherworldly as 15th-century alchemy. Even to those familiar with planning theory, PC-based project management programs suffered from being difficult to use or short on functionality.

But this is changing. The five programs reviewed here—*Micro Planner for Windows, Microsoft Project, SuperProject Plus, Time Line,* and the beta release of *Harvard Project Manager,* all of which retail for under $600—include new, less-ar-

cane project-planning techniques and offer greater flexibility and sophistication in handling resources, costs, and progress reports. They also accede to the pressure for connectivity by offering LAN support—even if it is somewhat limited. These are the best and most popular low-end project management programs designed for working on small projects. If your projects are becoming shorter in duration and narrower in scope, now is the right time to turn in your yellow pad, number 2 pencil, and desk calendar for a computerized solution.

Project planning will never be made painless, but one of the ways software vendors are making it a more-comfortable exercise is by including outlining tools in the new releases of their programs. Three of the products reviewed here—*Time Line*, Version 3.0, *SuperProject Plus*, Version 3.0; and *Harvard Project Manager*, Version 3.0—now support outlining. Before long, nearly every package is sure to use it.

It's not surprising that outlining has so quickly become a popular planning technique. It has the virtue of being as easy to pick up again as riding a bicycle, no matter how many years have gone by since your last outing, and as logical as common sense, in that you organize a series of activities by establishing narrowing levels of detail. Above all, it is much easier to use than such traditional approaches as the work breakdown structure (WBS), with its strict coding rules and building-block organization, or the network diagram, whose boxes and arrows end up looking like an erector-set construction gone awry.

Outlining offers a visual advantage as well. In order to display the boxes and linking arrows of a WBS chart or network diagrams, you need a lot of room on-screen. Typically you can see only a half-dozen boxes or tasks at once. But with an outline you can see anywhere from 25 to 43 lines of tasks, depending on your monitor type. While an outline can't reveal complex task dependencies, its hierarchy of indented lines shows parent/child task relationships and the basic sequential flow of the project.

Outlining is a great tool for creating a summary view of your project, and it also acts like a zoom lens. You can get a wide-angle picture of your project or an extreme close-up by closing and opening the project levels. Higher-level tasks sum the durations and costs of those beneath them, so if you close up everything but the top levels in your project, you get a summary of the major phases. Outlining is integrated with the different project views, so the Gantt chart and network diagram will change as outline levels are opened and closed. Since the Gantt chart is the primary graphic view of a project—because it shows the timing and duration of tasks in horizontal bars under a date line—instant summarization of its task bars is very useful. (For more information on project management methodology, see the sidebar "A Project Management Primer.")

■ If your projects are becoming shorter in duration and narrower in scope, now is the time to turn in your yellow pad and number 2 pencil for a computerized solution.

SIMPLER TO USE Project management programs have been made operationally and conceptually easier to use in other ways. For example, if you invoke *Time Line* 3.0's Schedule/New command, a series of forms pops up that walks you through the process of creating a project calendar, adding resources, and setting schedule options—everything you need to get started. *Time Line* 3.0 also has a much more thorough context-sensitive help facility, as does *SuperProject Plus* 3.0.

Harvard Project Manager, which we looked at in its beta release, has an entirely new approach to building a schedule, called Fast Track. It combines characteristics of the Gantt and network charts with the entry style of a word processor. You enter tasks under a date line by moving the cursor to the start date you want. Then you type the succeeding tasks on the same line, unless they occur simultaneously. If that is the case, you just move the cursor down to another line in a parallel position and enter the task. The length of the task line indicates its duration; you can lengthen or shorten task lines or move them to another start date.

Other improvements you should look for in these new programs include more shortcut keys for jumping between screens or initiating commands and the ability to enter task data from almost any screen in the program. *Time Line*, for example, lets you record a keystroke macro for replicating task data—such as duration and resources—but it can't be saved and reused. *SuperProject Expert* (not reviewed here because of its slightly higher price, $695) has a full-featured macro capability that allows you to create complex reusable routines. Macros are likely to become more prevalent as time goes on.

Because a project is the sum of its parts, the more views you get of it, the better your understanding will be. The programs that are reviewed here offer more views on a project—some of them variations on old views—and let you access them with greater ease. *Time Line*, for example, now offers a stack of five histograms under a Gantt chart, rather than the pair of histograms of past versions. *SuperProject Plus* has special viewing windows tied into each of its main screens. If you are looking at the calendar screen, you can call up windows of schedule and cost information for the resources assigned to each task on the date highlighted. This information can help you resolve resource conflicts while you are still using the calendar screen. *Micro Planner* now offers a cost histogram, which shows the money spent on a resource over a period of time. This histogram can be displayed in the typical solid-vertical-bar format, or as hollow bars that make the final product look like a line graph. *Microsoft Project*, Version 4.0, can print a cost histogram but can't display it on the screen.

The traditional Gantt chart has also undergone some renovation. You can now customize the data fields to the left of the task bars in some programs. *Time Line* allows for up to 16 data columns from a list of 60. *SuperProject Plus* lets you have 15,

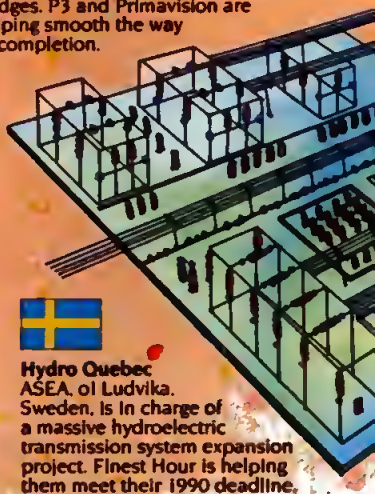
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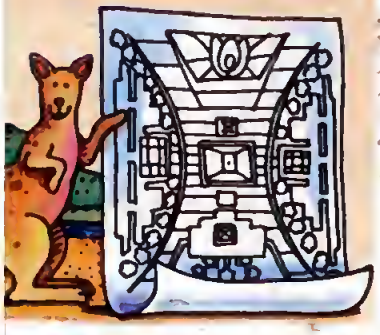
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but only on an output report. The data columns supplement your understanding of a project. They can tell you the percentage of a task achieved, dollars spent, the duration to go, resources, and so on. With *Time Line*, you can save Gantt chart variations and call them up for specific analyses or presentations.

ALLOCATE RESOURCES In addition to being easier to use and offering new project views, the programs reviewed here have become more sophisticated at handling resources and costs. One refinement to resource handling that you should look for is a program's ability to partially assign resources to a task or to split their assignment. In *Time Line* 3.0, for example, you can allocate a resource—up to a maximum you have set—for a certain percentage of time. This makes it easy to share a resource with other tasks or even with other projects. The percentage figure also gives you a way to account for work productivity. If you know that a person is tied up in meetings or is busy doing general administrative chores 25 percent of the time, then he or she could be assigned to a task for the remaining 75 percent. If the productivity of your manufacturing plant has dropped to 85 percent of what it used to be, you can model this, too.

Along this line, *SuperProject Plus* 3.0 allows you to split resource assignments into hours per day or by a percentage of the work day. These assignments can last for the duration of a task or until a specified number of hours has passed. By setting task priorities, you can interrupt a task in progress and shift a resource to a higher-priority task; the first task will be delayed until the resource is available again.

Still another approach to splitting resources is used by *Micro Planner:* it changes the amount of resources assigned at different points during a task. You might want to assign four people on the marketing team to the first 2 days of an activity, and then assign two of them to another aspect of the project, leaving the other two people to work on the original task for its remaining time.

Individual resource calendars give you further assignment flexibility because they individualize work-hour schedules and days off. *SuperProject Plus* was the only program reviewed here that had resource calendars in its prior version. Now *Microsoft Project* and *Harvard Project Manager* include this feature.

Project management programs have also gotten smarter at working with different types of resources. *Micro Planner*, for example, distinguishes between normal resources and pool resources. A pool resource is something that is gradually consumed during a task, like bricks. The program lets you record varying availability of pool resources by setting a series of "change points." A change point is a date on which a certain quantity of the resource will be added or subtracted. You can indicate as many as 20 change points for each resource.

■ As the resource-handling capabilities of project management programs improve, so do their cost-entry and tracking capabilities.

Project costs are inextricably bound to resource use. As the resource-handling capabilities of project management programs improve, so do their cost-entry and tracking capabilities, making them more-useful cost-containment tools. Until recently, it was not uncommon for project management programs to deal with costs in a perfunctory way, as if they were only of marginal interest. The reasoning behind this seemed to be that you would enter cost data into a separate spreadsheet, where you would do your calculations. Now it is commonplace to be able to enter costs into a project management program on a variable, fixed, or per-unit basis. To this mix, *Harvard Project Manager* has added penalty costs. Some of the programs even let you specify how money is spent. With *SuperProject Plus* you can indicate that costs will accrue at the beginning or end of a task, or be prorated over its duration.

SPECIAL REPORTS Cost data is of most interest during the tracking phase of a project, when the best-made plans tend to unravel. The best way to discover a snag, before the whole project is undone, is through progress reports. But, here again, earlier versions of project management products designed for small projects did only a so-so job. They offered a relatively small number of preformatted reports, which could be customized only by restricted selection and sorting facilities. This is an area where the more-expensive, powerhouse project-management programs like *ViewPoint*, *Open Plan*, and *Primavera Project Planner* have done a consistently good job (see the sidebar "Is the Low End Too Little?").

Now, however, the programs reviewed here are starting to strengthen their reporting systems by increasing the number of canned reports they produce—especially those concerning earned-value reporting, a requirement in government projects. Even more important, their custom report features give you nearly total control over data columns. You get to pick the data types and then filter them by opening or closing outline levels, specifying ranges, or using wildcard selections. Some of the programs have also added new calculated data types. For example, *Time Line* now offers budgeted cost of work scheduled (BCWS), estimated-at-completion (EAC) cost (both required in government projects), spending-rate ratio, duration remaining, and more. The new *Time Line* and *Harvard Project Manager* also let you save customized report formats so that they can be reused on the same project or transferred to another project.

Control over reports has been extended to formatting. Generally, you can now enter headers and footers and set the page breaks. With *Harvard Project Manager* and *Micro Planner*, for example, you can scale graphic reports to any size. *Micro Planner* goes even further by enabling you to change fonts and point size for text. Because it runs under *Microsoft Windows*, you see on-screen how the text and graph will look, with a shaded vertical line for the page breaks. You can print in portrait or landscape orientations and high- or low-quality mode, and you can send output to a plotter.

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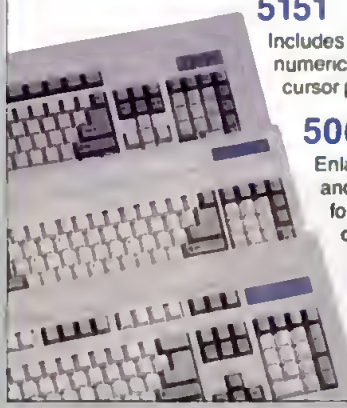


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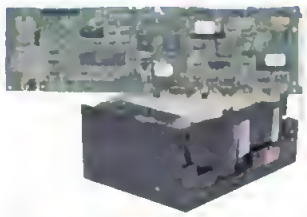
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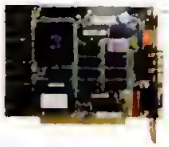
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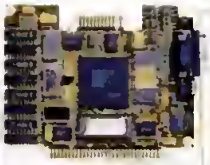
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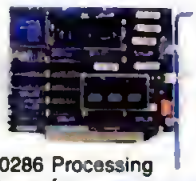
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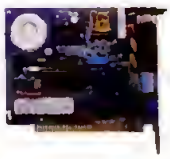
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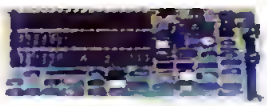
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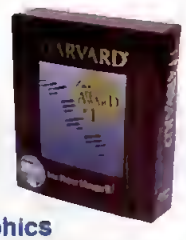
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Project management is a way of imposing structure on a complex intertwining of time, resources, and activities. It requires a panoramic eye, logical thinking, a measure of statistical dexterity, a feel for detail, and a willingness to bow to circumstance. Using a PC will help, but only if you understand the methodology of project management.

Planning is the first phase of project management, yet it starts with the project's end—its objective. You have to know what you want to achieve before you can figure out how to do it and what it will cost. With the objective in mind, you can set down the steps that lead to it. If, for example, your objective is to move your company to another location, you might have jotted down "site selection," "renovation," and "move." As you add activities to the list, you also add detail, so site selection may be composed of "conduct needs analysis" and "survey buildings," and these tasks will in turn be composed of others. Before long you start to have a sense of the project flow. Logic will dictate which activities must follow each other and which ones can occur simultaneously.

Outlining, which has recently become part of the best low-end programs, is a very good way to do the list-making part of planning. You can also use other, more-traditional project management techniques in conjunction with outlining; each will yield additional understanding of your project.

One of these traditional approaches is the **network diagram.** It is something like a graphic representation of an outline turned on its side so that its progression is horizontal. There are actually two ways of drawing it: the arrow diagraming method (ADM) and the precedence diagraming method (PDM). In an arrow diagram, activities are represented by arrows placed between a start circle and an end circle. The circles are points in time. *Micro Planner* is the only program reviewed here that uses this method. In a precedence diagram, tasks are represented by boxes, which are connected by arrows showing the project flow. PDM is the more popular of the two methods and is used by all the other packages.

While network diagrams illustrate the general movement of a project, they are missing a crucial element: time. The **Gantt chart** takes this element into account. The Gantt is a horizontal bar chart laid down under a date line scaled in minutes, hours, days, and so on. Activities are listed down the rows on the left side of the chart, and the bars representing them are sized to show their expected duration. The order of the bars from top to bottom gives you some of the same sequential information as the network diagram. The Gantt chart shows you the start and end dates for every activity and for the project as a whole.

The Gantt chart is often used as the central view of a project because it can display a lot of information at once. In addition to time and sequence, you can see which tasks are crucial to the on-time completion of the project. These linchpin tasks are determined by a process known as the **critical path method** (CPM). The algorithm used to determine the critical path revolves around task durations, their sequence, and constraints.

DEPENDENCY CONSTRAINTS

Constraints ordain the relationships between tasks. For example, some tasks can't begin until others are completed, as a function of physical or logical laws. If you're erecting new walls in an office space, then the framing must be done before the wallboard can be put up. This is a physical constraint. Task relationships with this pattern are said to have a finish-to-start dependency. There are several other dependency types: finish-to-finish, start-to-start, and start-to-finish.

An example of a start-to-start dependency would be planting shrubs and spreading bark mulch. You can't put the mulch down until you've started to put in the shrubs. This illustrates another type of dependency: lead and lag time. Mulching should start only after planting is under way, because mulching takes less time. If you were charting these activities, you would assign a lead time to the task of mulching. If a task must begin some time after another one has finished, you would use lag time.

Each task can have a number of dependencies at once, making the relationships in a project schedule very complex. To figure out the critical path, a PC-based project-management program determines the earliest and latest possible start and finish dates of tasks, factoring in their dependencies, durations, and the start date of the project. The critical path tasks are those whose early and late dates are exactly the same—in other words, they must start and finish precisely on time, because a delay in any one of them will delay the whole project.

The critical path is displayed on the Gantt chart by coloring the bars red, by making them solid, or by using some other visual cue. Noncritical tasks are displayed differently and can also be distinguished by a trailing or leading line. This line represents float, which is the amount of time a task can slip without affecting the end date of the project. All of the programs reviewed here use CPM as the basis for planning.

Another planning technique, the **Program Evaluation and Review Technique** (PERT), is often used as a synonym for CPM or for network diagraming. But it is a very distinct and specialized technique for dealing with

(continues on next page)

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- Westney, Richard E. *Managing the Engineering and Construction of Small Projects*. Marcel Dekker, 1985.

uncertainty in task duration. When one uses PERT, every task is given an optimistic, pessimistic, and most-likely duration. The varying durations are analyzed through probability equations to derive one number per task. None of the programs reviewed here use PERT (although they may call their network diagrams PERT charts), but *SuperProject Expert*, the more fully featured sister of *SuperProject Plus*, does offer it.

COMMITTING RESOURCES After the critical path has been determined, you are ready to assign people, equipment, and materials to each activity. These are the project resources. Information about their quantity, daily availability, and cost are entered on task and/or resource screens. Resources can have a tremendous impact on the schedule. If, for example, a task would normally take 3 days to complete, but your resources can be applied for only 4 hours a day, the task will take 6 days. Resources may also control the start date of a task. If a task could begin on October 1, but the needed materials won't arrive until October 15 or a key person isn't available until that date, then that's the real start date for the task.

Typically, once you've assigned resources to specific tasks, you will discover that some are overallocated. You can see this most clearly by looking at **resource histograms.** A histogram is a vertical bar chart of resource capacity. If a resource is assigned full time to two tasks during the same period, the bar will top the maximum line on the chart, and it may be shown in red or flash at you.

There are two approaches to correcting resource conflicts—adjust the resource availability or delay tasks and, probably, the project. Most programs will automatically reschedule tasks with conflicts through an approach known as **automatic resource leveling.** In one type of resource leveling, only available float time is used to change task dates. But this is often an insufficient answer to the problem. The other kind of resource leveling will delay even critical tasks, thereby delaying the whole project. But neither of the automatic techniques may give you an optimum schedule. You may have to manually readjust resource availability, move tasks around, or even rethink the way an activity is accomplished.

But when the resources are finally assigned, the critical path set, and the costs entered, you have a complete project plan. This plan is often referred to as the **baseline.** It is saved and used as a standard against which to measure the progress of the project as it unfolds.

TRACKING PROGRESS After the baseline is created, you enter the second phase of project management: **tracking.** Now you will be entering actual start dates, resource time spent, percentage of task completion, and costs. This data might be entered weekly, or, for critical or very short projects, daily.

The tools for this part of a project are the actual-versus-baseline Gantt chart and a battery of progress reports. One of the most important reports is called **earned value.** It can actually be calculated in a variety of ways, but it is essentially a measure of the impact of cost on a task in progress when it is compared with the baseline. For example, if you have achieved 50 percent of a task's objectives halfway through it, and the baseline cost estimate for the task was $25,000, then you have an earned value of $12,500. Earned-value reporting is required in government-contracted projects.

The other reports you generate during the tracking phase will serve as summaries of progress for upper management or detailed blueprints of tasks and resources for line managers. The reports will also indicate problems that are the result of unforeseen circumstances. This will send you back to planning activities like resource leveling.

Project management is difficult and time-consuming. It forces you to think through a complex process and then record detailed, actual data. But if you follow through on the method and use a PC-based project manager for all the computational, graphic, and reporting support it can supply, your skill at project management will continue to grow. And this will most certainly have a payoff on the bottom line.—**Henry Fersko-Weiss**

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IS THE LOW END TOO LITTLE?

When it comes to project management software, higher prices don't necessarily mean higher quality and functionality.

Project management software can be broadly separated into a low end and a high end. The most obvious demarcation is price. Low-end packages cost under $600; high-end programs range in price from $600 to $8,000. Although it's tempting to associate higher prices with richer functionality and better quality, some of the low-end programs reviewed here are as feature-rich as programs that cost $2,000 or more. In general, though, high-end project managers such as *Open Plan*, *ViewPoint*, *Plantrac*, *Primavera Project Planner*, *Promis*, and *Qwiknet 500* are able to manage larger projects, can define costs in greater detail and with more precision, and will produce better, more-varied reports than even the best low-end programs. On the other hand, low-end programs are easier to use, have better-designed screens, are more interactive, and are much faster than programs at the high end.

The most important functional difference between the two ends of the market is the size of the project each can handle. Low-end programs can manage only a fraction of the activities the high-end programs can oversee. For example, *Time Line* 3.0 is limited to 1,000 tasks per schedule, *Microsoft Project* 4.0 is limited to 999 tasks, and *Micro Planner* can handle 1,340 tasks. *SuperProject Plus* is limited by the size of RAM, so in a 640K system, depending on the number of resources and other project data, you could have about 2,000 tasks. On the high end, by comparison, *Open Plan* and *Primavera* can each manage 10,000 activities; *Plantrac* can handle up to 62,000 tasks.

Because they can handle larger projects, high-end project managers are also more adept at managing multiple projects. They usually keep project schedules independent of each other, but they can share and level resources across projects. By contrast, low-end programs usually join multiple projects into an overarching project in order to share resources. But by becoming subprojects, multiple projects lose their individual identity.

A program's orientation toward large or small projects leads to other differences. Most of the low-end programs keep a project in RAM while you are working on it. This means that resource leveling and recalculation of the project schedule or costs happen very quickly. High-end programs have to go back and forth to the disk to fetch activity, cost, and resource data, so they tend to be considerably slower.

Many high-end PC programs began life as mainframe products and still retain an un-PC-like look and feel. Less interactive than programs designed specifically for PCs, they are complex and typically difficult to use, relying on command languages rather than menus. As a result, it will take you a lot longer to learn how to use a high-end product, and it may even require that you take a specialized training course. Low-end programs, written from scratch to take advantage of the PC's sophisticated user interface, make use of menus, dialog boxes, and eye-catching screens. You'll find that these programs are much easier to use and have better built-in help facilities than their higher-priced peers.

Until recently, high-end programs did a better job of defining and allocating resources. But this is no longer true of the five low-end programs reviewed here. Any one of them lets you do partial work assignments, have individual resource calendars, and define a variety of resource types.

In addition to being better able to manage multiple projects, high-end programs also do a better job of handling the cost side of project management. For example, most low-end programs allow for only one cost rate per resource, while high-end programs may allow as many as

ROOM FOR IMPROVEMENT In spite of all the areas of improvement, project management programs still need to do a better job of handling resources and costs. The reporting capabilities of the low-end programs would be bolstered by the addition of a full-scale report writer. They could also do better at managing multiple projects. Most of the programs reviewed here handle multiple projects by making them subprojects, with the result that multiple projects lose their identity.

LAN support is another area that has room for improvement. Today, most project management programs claim to support LANs, but it is the weakest form of support—allowing read-only multiple file access, but nothing more. None of the programs reviewed here offers record locking. Project management is a natural for the connected world of LANs. True LAN support would benefit line managers from different departments of a company who need to regularly access updated schedules, as well as those who need to track multiple projects.

Even with these limitations, the programs reviewed here do an admirable job at managing small projects. As a group, they are relatively easy to use and offer a host of well-implemented features. They should erase the bad reputation from which project management has long suffered.

Micro Planner for Windows

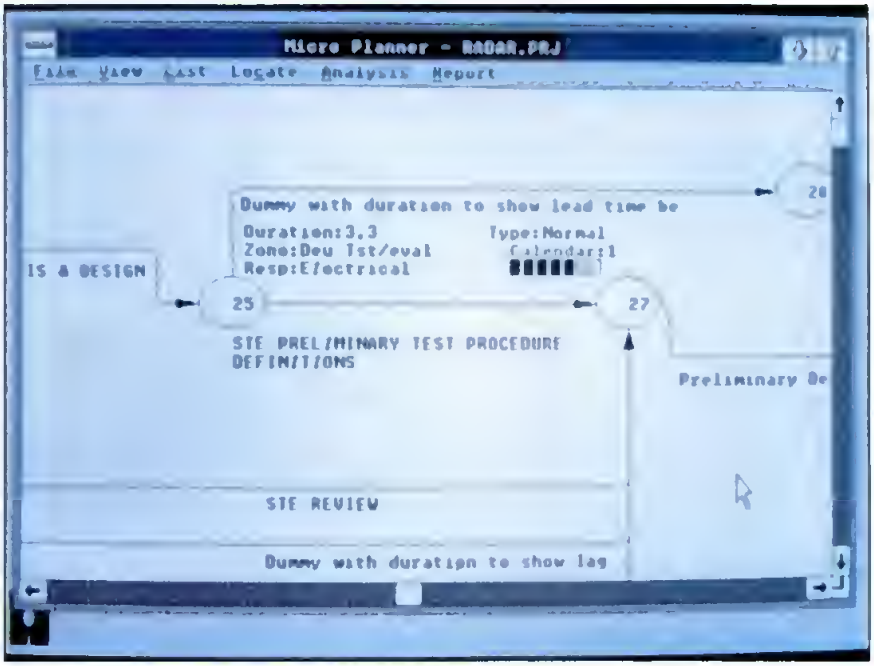
Micro Planner for Windows, from Micro Planning International, is the only project management program reviewed here that runs under *Microsoft Windows*. Because of the *Windows* environment, the $595

six. Usually you can have but one overhead cost per activity on the low end, whereas on the high end you might have five or six. And, in general, high-end products calculate a greater variety of cost measures, such as budgeted cost of work performed (BCWP), budgeted cost of work scheduled (BCWS), and a whole series of cost/schedule control system criteria used by government agencies.

Some of the low-end programs are starting to address these shortcomings. *Time Line*, for example, has added BCWS and BCWP, along with actual cost of work performed (ACWP) and several other such cost-performance measures.

Reporting is the last major area of difference between the two ends of the market. Many high-end programs have full report writers, letting you generate almost any kind of report. Low-end programs typically have a restricted number of preformatted reports, which you can customize by specifying selection criteria and sorting routines. Yet even these reporting facilities are better on the high end. For example, you can sort on many more levels at once—up to 32 in *ViewPoint*. On the low-end, three sort levels is a fairly common limit.

—Henry Fersko-Weiss



Micro Planner for Windows' *main planning tool, the network chart, makes use of the Arrow Diagramming Method (ADM). The circles represent start and end points of project tasks named along the arrows. The seven boxes (for the 7 days of the week) of the work calendar and the Duration, Zone, and Responsibility information are dedicated to the task in the center, which is the focus of the chart.*

program is blessed with a first-rate graphics interface. You plan a project by clicking and dragging activity lines to event boxes, instead of typing an outline or numbering predecessor and successor tasks. *Windows* also allows *Micro Planner* to display on-screen the fonts and scaled graphics that will appear in reports. But running under *Windows* also means that the program can be slow at times, particularly when it needs to repaint a complex screen.

The previous version of *Micro Planner*, 5.0, was a Macintosh product. At the same time that Micro Planning International upgraded its Macintosh program, it also released the program reviewed here. If you have master copies of both versions, you can exchange files between the two systems. Corporate users in a mixed-hardware environment now have a seamless way to share project data.

GO WITH THE FLOW You build projects in *Micro Planner* by drawing a network model. The model looks like a flowchart or a PERT (Program Evaluation and Review Technique) chart, but unlike the traditional approach, events are represented by circles and tasks are the arrows running between them. You draw the arrows by clicking the mouse on a circle and dragging a straight line left or right. Activities flowing into events from the left must occur before activities flowing out to the right. Events are merely points in time—the glue between activities. In spite of what the name *events* implies, they do not involve any action and don't take any time.

The flow of the arrows represents dependency relationships between tasks, so this doesn't have to be specified on an activity form. There are five different event types and ten activity types. This abundance of categories, along with the inherent expressiveness of a flow diagram, makes it possible to build models of very complex projects. For example, using the ladder, lead, and lag activity types, you could specify that Task B must start 2 days after Task A and that A must stay 2 days ahead of B, but can't finish until 3 days after B.

As the model grows, task arrows end up flowing in all directions, curving around groups of circles to link to events far across the screen. You can pan over the network by clicking on different tasks in succession. But as you do this, the view of the network keeps changing—tasks that flowed out of the top of an event now flow out its side, and straight-line arrows become curved. To add to the confusion, the network is severely abbreviated on the screen. You can see only a few events and

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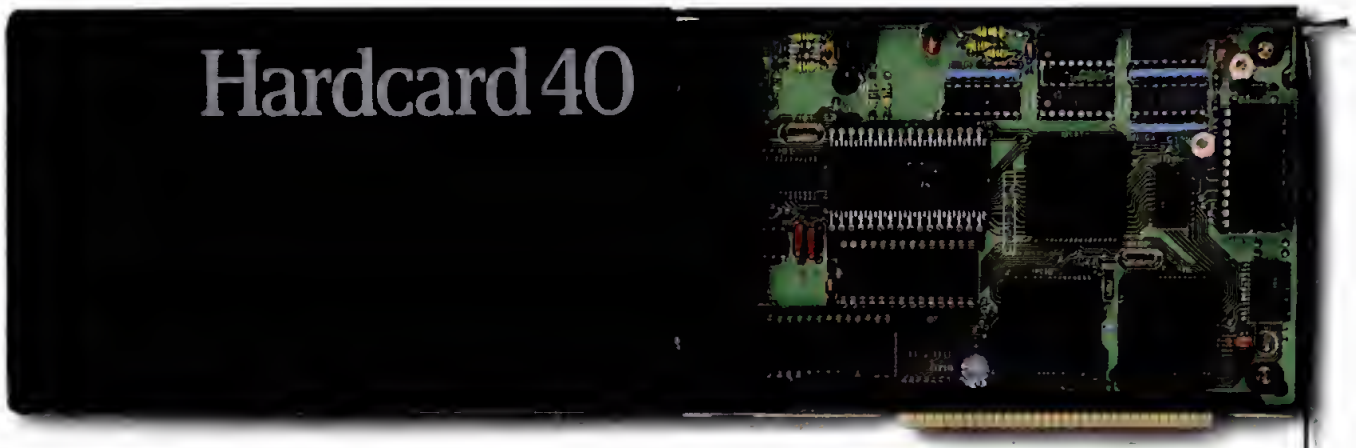
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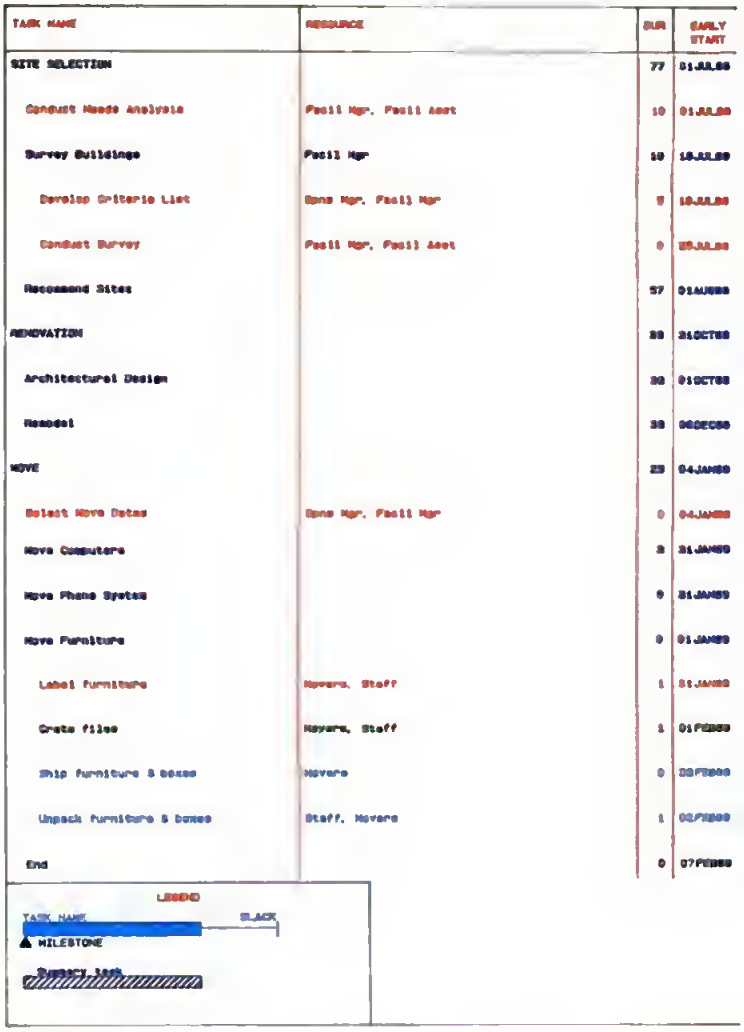
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PROJECT MANAGEMENT AT A GLANCE

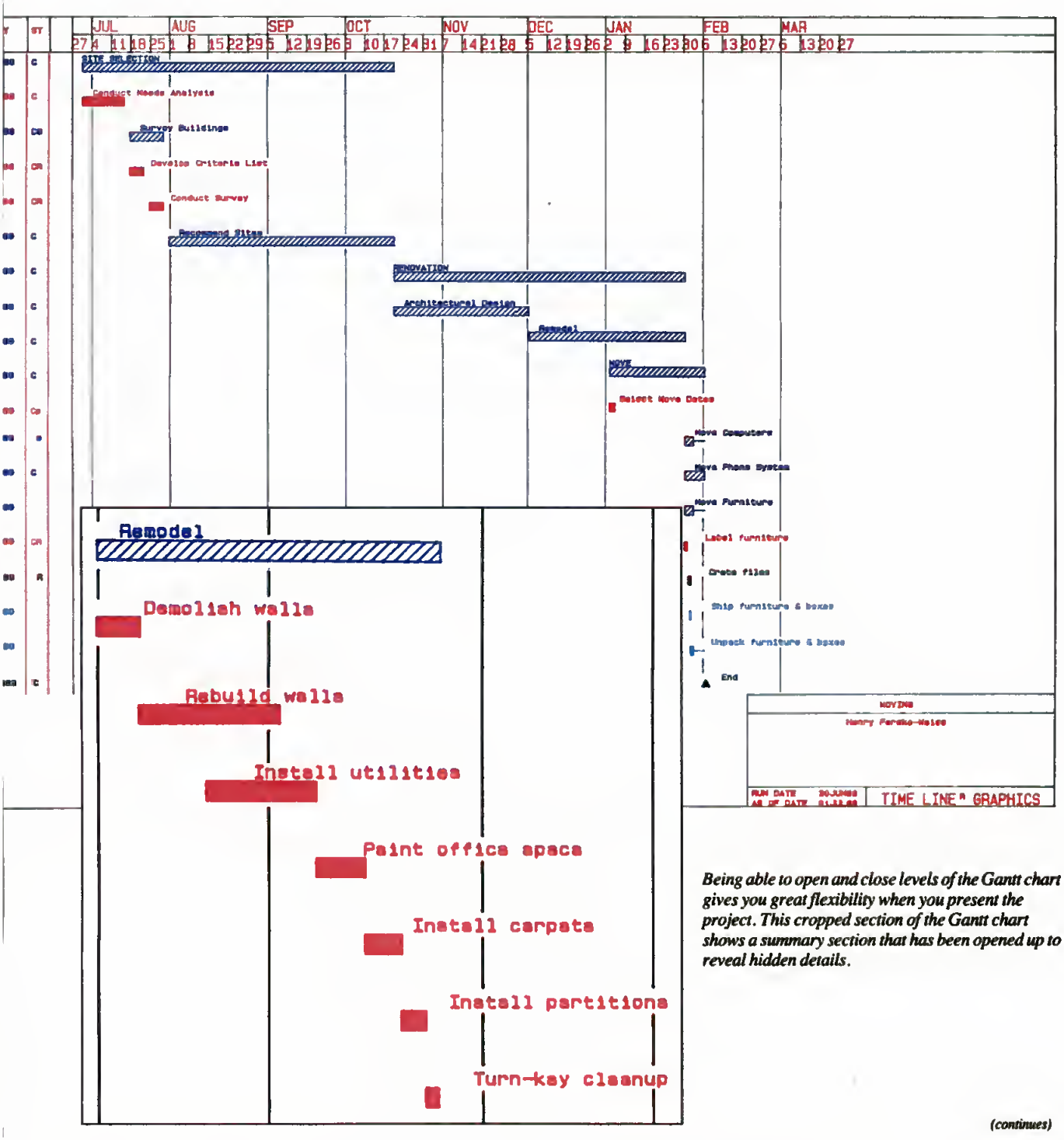
Regardless of the kind of project you need to model, you will come to rely on a number of graphics tools to ensure that every task and resource stays on course and that their interrelationships are properly defined. The graphics samples displayed here—a Gantt chart, an outline, a network diagram, two types of calendars, and a resource histogram—represent typical macrocosmic and microcosmic views of a project. As you plan and refine your project, using visuals like these will help you quickly spot milestones, dependencies, critical paths, and bottlenecks. Together, they should give you a sense of the project's overall pattern as well as an accurate and detailed picture of resource commitments. Also included here is a cost report, one of many standard reports that you might submit to top management during the life of a project.—**Henry Fersko-Weiss**



A Gantt chart is often used as the main view of a project because it displays a lot of scheduling information at once. This Gantt chart, created with Time Line, *shows the steps required to move a company from one location to another. The project starts on June 30, 1988, and ends on February 6, 1989. The duration of each project activity is represented by a horizontal bar under a date line; time is scaled in minutes, hours, days, weeks, or months. The length of the bar is proportional to the duration, so just glancing at the chart will give you an idea of the relative duration of tasks. The bars also report the start-to-start, finish-to-finish, start-to-finish, and finish-to-start dependencies between tasks. For example, the tasks Develop Criteria List and Conduct Survey are aligned so that the finish of Develop Criteria List is just before the start of Conduct Survey. This is called a finish-to-start dependency.*

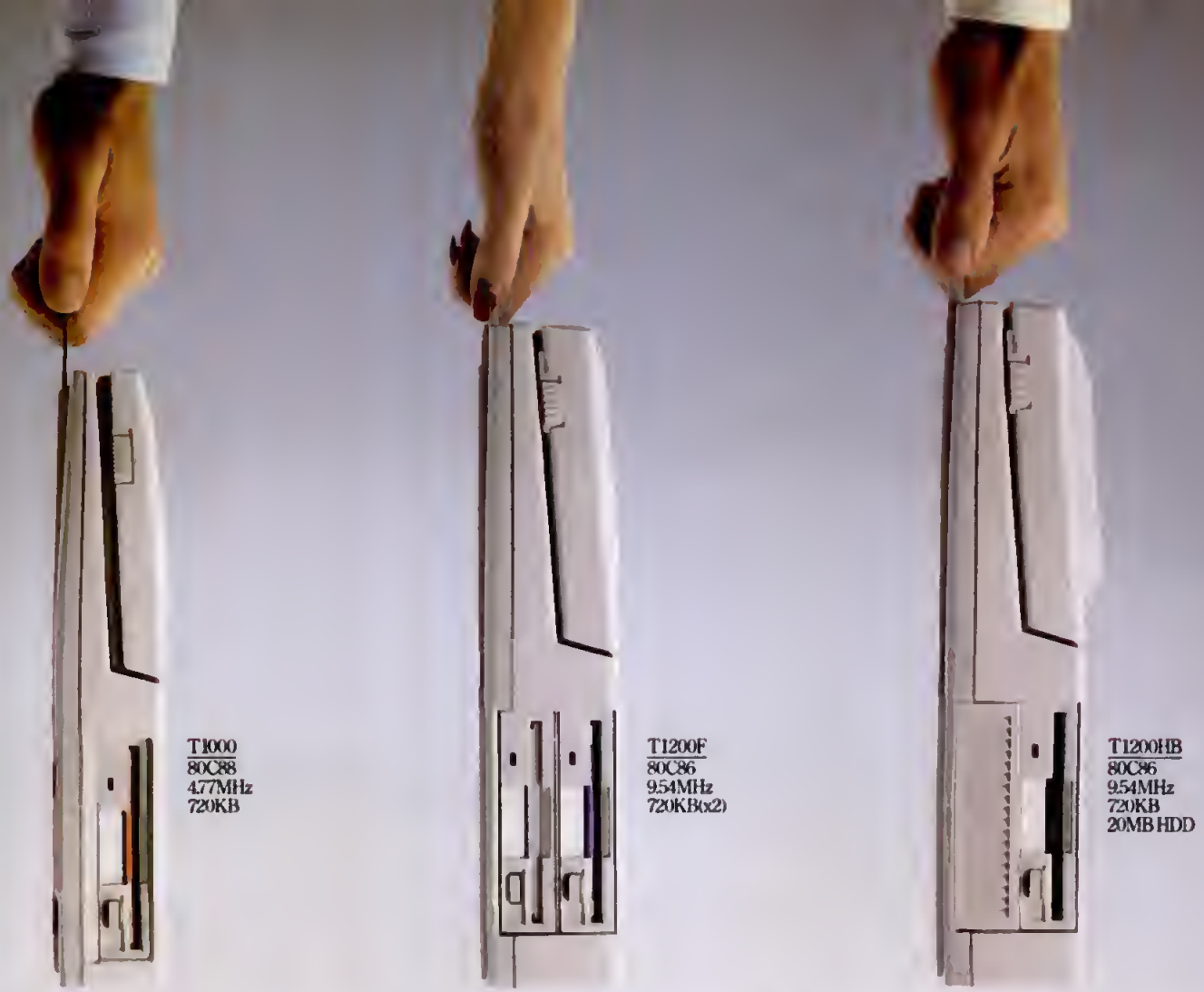
Color is another visual cue used by Gantt charts. The task bars in red indicate the project's critical path. None of these critical tasks can be delayed without delaying the entire project. Purple is used here for the summary tasks. The summary bars show the duration for all the detail tasks under them. Because Time Line *uses outlining on the Gantt chart, detail task levels are indented beneath their summary tasks.*

Besides the task names on the extreme left and the task bars on the right, Time Line *lets you include up to 16 columns of data. Displayed in this Gantt chart are the Resources, Duration, Early Start, and Early End dates, as well as the Status of the task. With only one chart you can exhibit many of the most crucial aspects of a project and at the same time highlight elements that would be of interest to senior executives or line managers.*



Being able to open and close levels of the Gantt chart gives you great flexibility when you present the project. This cropped section of the Gantt chart shows a summary section that has been opened up to reveal hidden details.

(continues)



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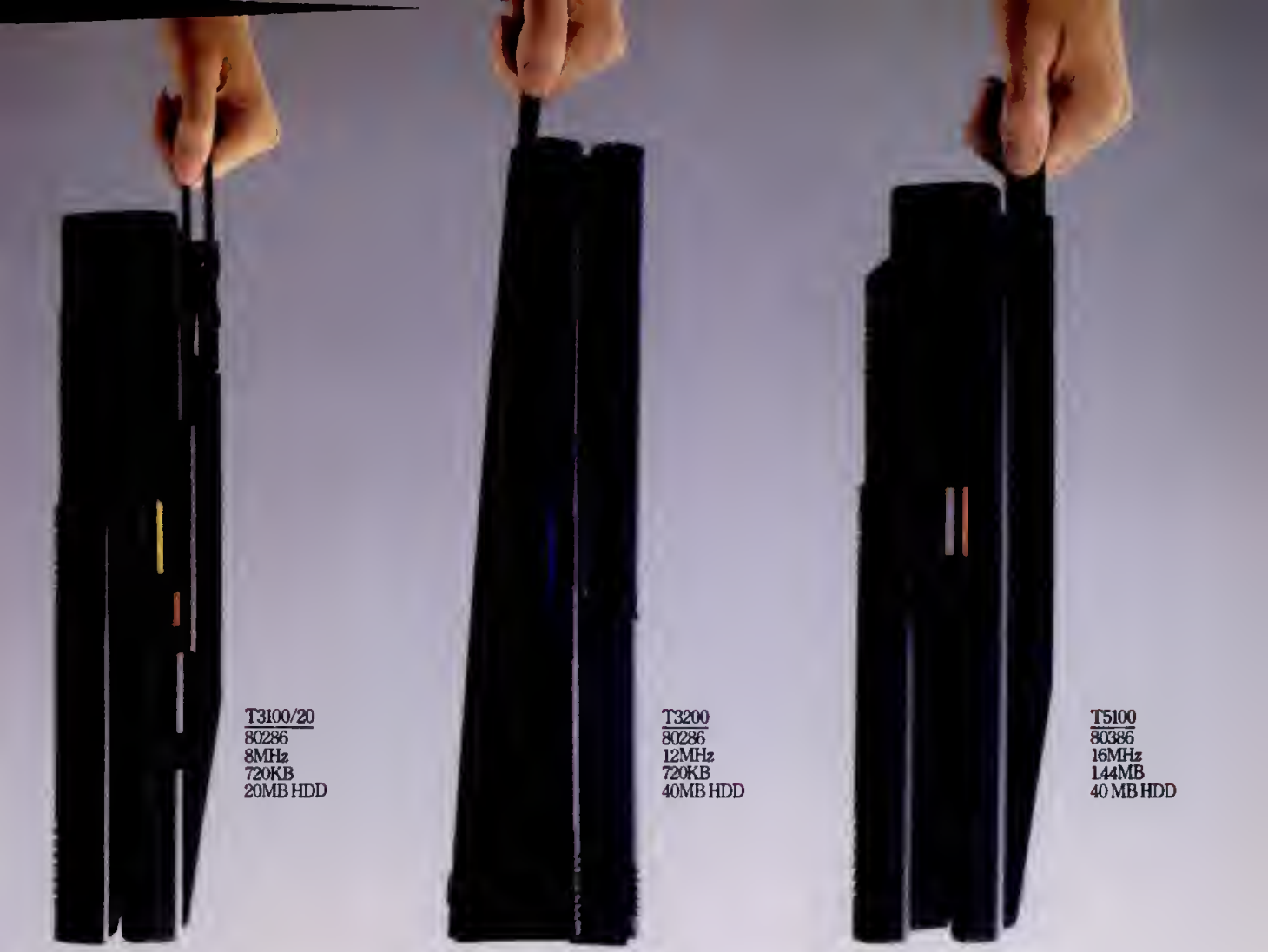
Perhaps that's why we have the largest number of high-powered, highly-portable PCs on the market today. All of which are IBM-compatible. All of which have industry-standard 3½" disk drives, full function keyboards and a vast array of built-in ports. All squeezed into packages as easy to carry as a briefcase.

The T1000, for example, weighs a mere 6.4 pounds, yet boasts MS-DOS® in ROM, a 720KB 3½" disk drive and an optional 768KB memory card which can be configured as EMS memory or a battery-backed RAM disk.

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T3200
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720KB
40MB HDD

T5100
80386
16MHz
1.44MB
40 MB HDD

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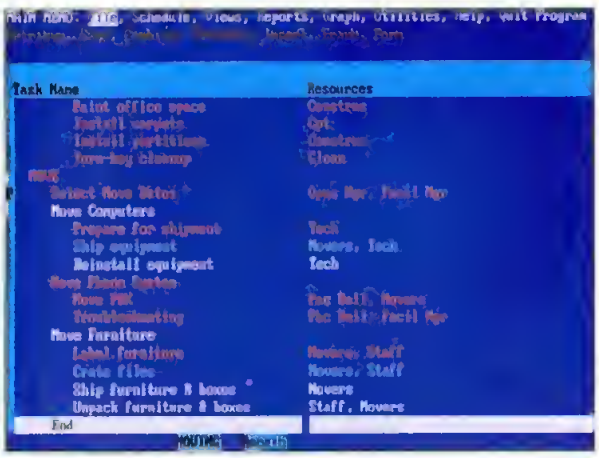
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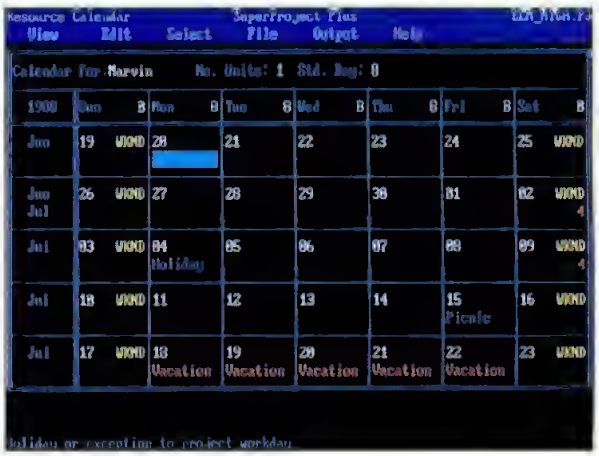
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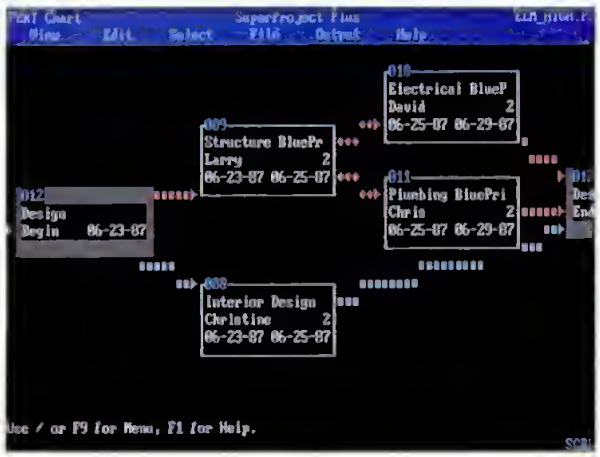
("Project Management at a Glance" continued)



The outline *is an excellent planning tool because it puts tasks into logical groupings. This outline screen from* Time Line *shows project tasks on the left. Each level of detail is indented beneath its parent task. On the right side of the screen are the resources assigned to tasks. Critical path tasks are in red.*



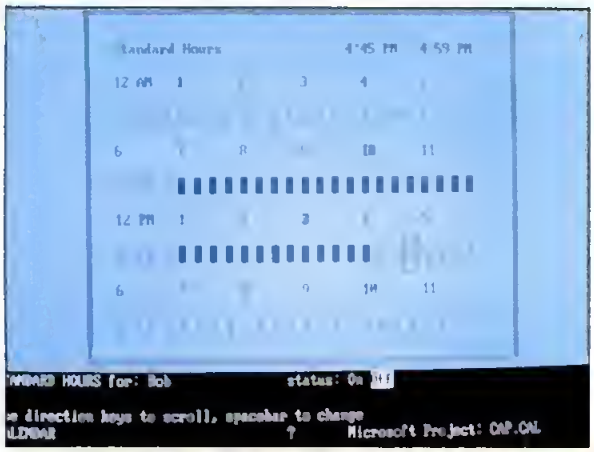
A daily calendar *gives you a great deal of flexibility in resource assignment. In the Resource Calendar from* SuperProject Plus, *company holidays are in blue and resource vacation time is in red. The standard work schedule is Monday through Friday, 8 hours a day. But the number 4 on July 2 and July 9 shows that the resource is scheduled to work 4 hours on these two Saturdays.*



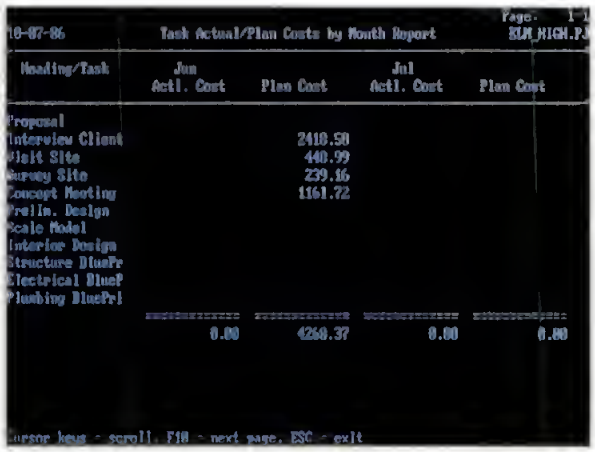
A network chart *shows the general flow of a project and helps you to see its logic.* SuperProject Plus*'s network chart exemplifies the Precedence Diagramming Method (PDM), which shows project tasks in boxes linked by arrows to indicate the project flow. The red lines represent the critical path. Task details reside within the boxes.*



Resource histograms, *like this one created with* Micro Planner for Windows, *let you see when a resource is over- and underutilized, so you can make your schedule more efficient. In this resource histogram, the first few vertical bars reveal that only 7 out of 10 units of this resource are being utilized at the beginning of the project. Then 9 out of 10 units are assigned. If this resource had been overallocated, the work load bars would extend above the maximum line and would be displayed in red.*



With **an hourly calendar** *like the one offered by* Microsoft Project, *you can record the exact hours a resource is available each day—and even indicate a lunch break or other regular time off.*



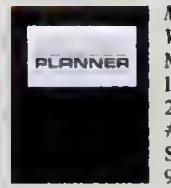
During the tracking phase of a project, reports like SuperProject Plus's **cost report** *are essential for making sure that your project has not gone over budget. Shown here is the first page of the program's cost report, complete with the planned costs for June 1988.*

activities at once. If you have to change the way activities and events are linked, you must move back and forth across the network to see the overall impact of what you're doing.

It takes time to get comfortable with the diagram approach—especially if you're used to building a project in a Gantt chart or by outline. You also have to spend more time thinking a project through and, perhaps, fiddling with a design on paper first.

You enter activity durations as you create the network diagram, so time can be factored into the project. This occurs in the Activity window, which pops up over the network diagram. Durations can be recorded only in weeks and days. You can choose among six work-week calendars, applying them individually to tasks, and you can customize them by toggling work days on or off. Multiple calendars make it easy to deal with different work shifts. A project calendar of months, extending 2,144 days (almost 6 years) into the future, lets you mark off holidays. But the program has two quirks: it assumes an 8-hour

PC MAGAZINE FACT FILE



***Micro Planner for Windows*, Version 6.0**
Micro Planning International
235 Montgomery St., #840
San Francisco, CA 94104
(415) 788-3324
List Price: $595
Requires: 512K RAM; hard disk; *Microsoft Windows*, Version 2.0 or later, EGA or VGA graphics adapter; *Windows*-compatible mouse; DOS 3.0 or later.
In Short: Because *Micro Planner* runs under *Windows*, it has a very nice graphic interface. The main planning approach—a network chart, with activities placed on an arrow rather than in a box—takes getting used to and can be visually confusing. The program does an excellent job of handling resources and resource leveling and allows you to control the scale and fonts on graphic reports. *Micro Planner*'s weaknesses are its limited cost-analysis features, the 1-day limit on the Gantt time scale, and the low number of resources you can assign to a task. Not copy protected.

CIRCLE 673 ON READER SERVICE CARD

Project Management Software: Summary of Features

(Products listed in ascending price order)

	PC SuperProject Plus 3.0 $395 Upgrade, $50	Microsoft Project 4.0 $495 Upgrade, $75 from 2.0 or 3.0, $125 from 1.0	Micro Planner for Windows 6.0 $595 Upgrade, $100	PC Time Line 3.0 $595 Upgrade, $99
NETWORK VERSION				
Cost of master program	N/A	$495	$595	$595
Cost per additional user	N/A	$150/node	$299	$195 for LAN pack
Site license available	●	○	●	●
MEMORY USAGE				
RAM requirement	384K (512K recommended)	600K	512K	640K
Expanded memory	○	○	○	●
Extended memory	○	○	○	●
HARDWARE SUPPORT				
Hard disk required	○	○	●	●
Mouse support	○	●	●	○
Printer/plotter support	●○	●●	●●	●○*
VIEWS				
Gantt	●	●	●	●
PERT	●	●	●	●
Histograms	●	●	●	●
Other	WBS, outline, task and resource details	Split-screen Gantt, split-screen histogram, cost bar chart	Supercritical activity,worst case, tabular	Planned-versus-actual
ORGANIZING TOOLS				
Outline structure	●	○	○	●
No. of levels	9	N/A	N/A	Unlimited
Work breakdown structure	●	●	●	●
Organizational breakdown codes	○	○	●	●
Subprojects	●	●	Optional	●
Automatic roll-up	●	●	●	●
Multiple projects	○	●	●	●
CUSTOMIZING TOOLS				
Project journal	○	○	●	●
Notes capacity	Up to 5K	214 characters	256 characters	Up to 6K
Named layouts	●	●	○	●
Named filters	○	●	○	●
Wildcards, criteria	○	●	○	●
Sorts by field	●	●	●	●
TASK MANAGEMENT				
No. of tasks per schedule	Limited by memory	999	1,340	1,000
ASAP/ALAP/Fixed task	●●●	●●●	●●●	●●●

PC—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable: program does not have this feature.
* Supports plotters with optional $195 graphics package.

(continues)

day, and it forces you to begin a project on Monday.

After the network model is drawn, durations entered, and a project start date chosen, you can run an analysis operation that checks the model's logic. If everything is properly linked, the program calculates the earliest and latest start and end dates for each activity. For each linkage problem it finds, *Micro Planner* displays an error message box. After *Micro Planner* analyzes what's been done so far, you can view the project as a Gantt chart. Although this quickly-generated Gantt chart gives you a sense of the project's pattern, it has the task name written through it, which makes it visually unappealing. A much more attractive Gantt chart is available on the report menu.

RESOURCE-FUL MANAGER *Micro Planner* does an exceptional job of handling the resources side of project management. The program can manage two types of resources: normal and pool. Normal resources, such as people, are available for work each day. Pool resources, such as sheetrock, are consumed. For both types of resource you can specify 20 changes in availability during the project.

You assign resources through the Resource Usage window, which you access by clicking on the title peering out from beneath the top of the Activity window. You can have up to 20 resources per activity, but only 26 for the whole project. Start and finish dates allow you to commit resources to a specific period of an activity's lifespan. For example, you could employ all four members of your firm's marketing team for the first 2 weeks of a task and then use only two of them for the remaining time. In a resource window, you get to record the number of people or pieces of equipment available by type. Unfortunately, costs can be posted only as whole numbers and as a daily rate.

Micro Planner shines when it comes to resource leveling. Most project management programs do only one type of leveling—delaying task durations to accommodate resource availability. *Micro Planner* will do this in its Resource Critical Analysis. It will also treat a project's end date as inviolate and tell you how many resources you must add to specific tasks to hit that

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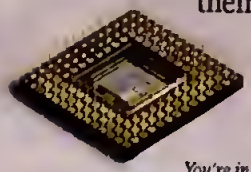


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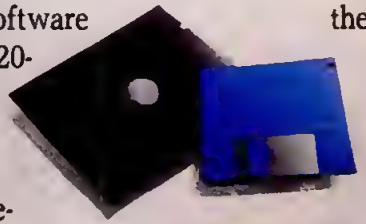
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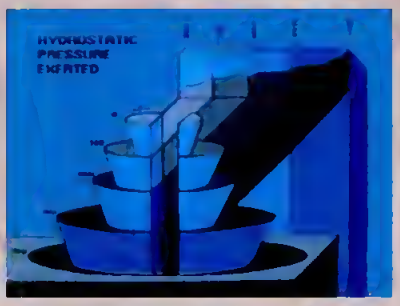
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COMPAQ

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end date. You can spot problem activities by looking at a bar chart. This also shows which tasks were already delayed by their float time. Displaying a usage histogram will tell you how many additional resources you'll need each day.

Sometimes neither solution works. It may not be possible to delay the project or to add the necessary resources. At this point most project management programs quit. Not *Micro Planner*. By using its ability to have separate calendars for each activity, you can stretch the available work time for the tasks in question.

Once you've finished building a project, you can save it as a Master plan. You can then compare this Master, and an additional Interim plan, with the project's real progress to look for variances. You update a project by entering actual start dates and/or the remaining duration. There are ten ways to report on a project's progress, including a bar chart, activity listing, progress report, cost report, and network diagram. These reports can be filtered by resources; activity types; zones, which are major structural areas, such as manufacturing; and responsibilities, which are usually department or manager designations. Activities can also be sorted by time.

While you can't customize a report so as to change its intent, you can customize its appearance and see the results on-screen, exactly as it will appear in a printout, right down to the vertical page breaks. You can pick fonts and point sizes, scale the graphic reports, and choose filled or hollow histograms. *Micro Planner* also lets you choose portrait or landscape orientation, print quality, and paper format. You make all your design and content choices with the usual *Windows* tools: dialog boxes, scroll bars, and radio buttons.

Because of *Windows*, *Micro Planner* is easy to operate. Yet it's not particularly easy to use. The distinction here stems from the program's use of the network diagram as the chief organizing tool for a project and the rich capability it has in accommodating activity types and resource usage. *Micro Planner* is a program that really makes you think your projects through. The reward for doing this is likely to be better-planned or more-flexible projects. On the down side, the program uses a limited time scale, its cost-analysis fea-

Project Management Software: Summary of Features

(Products listed in ascending price order)

	SuperProject Plus 3.0 $395 Upgrade, $50	Microsoft Project 4.0 $495 Upgrade, $75 from 2.0 or 3.0, $125 from 1.0	Micro Planner for Windows 6.0 $595 Upgrade, $100	Time Line 3.0 $595 Upgrade, $99
TASK MANAGEMENT				
Task durations	Hrs days, wks	Mins hrs, days, wks mos	Days wks	Mins, hrs days, wks mos
Dependencies	●	●	●	●
Task priorities	●	●	○	●
Maximum schedule duration	170 years	120 years	6 years	25 years
RESOURCE MANAGEMENT				
No. of resources per schedule	Limited by memory	255	26	300
No. of resources per task	Limited by memory	8	20	24
Partial-resource allocation	●	●	●	●
Resource-driven scheduling	●	○	○	●
Automatic resource leveling	●	●	●	●
Resource histograms	●	●	●	●
Individual resource leveling	○	○	○	●
Cross-project resource leveling	○	○	●	●
Resource calendar	●	●	○	○
TRACKING FEATURES				
Actual-vs.-planned Gantt	○	●	●	●
Baseline comparison	●	●	●	●
Percent complete	●	●	○	●
Cost tracking	●	●	●	●
Earned-value analysis	●	●	○	●
REPORTS				
Custom report	●	●	●	●
Resource reports	●	●	●	●
Cost reports	●	●	●	●
Status reports	●	●	●	●
Network reports	●	●	●	●
Cross-tab reports	●	●	○	●
Actual-vs.-planned reports	●	●	●	●
Variance reports	○	●	○	●
Gantt reports	●	●	●	●
PRESENTATION				
On-screen reporting	●	●	●	●

(continues)

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Project Management Software: Summary of Features

(Products listed in ascending price order)

	SuperProject Plus 3.0 $395 Upgrade, $50	Microsoft Project 4.0 $495 Upgrade, $75 from 2.0 or 3.0, $125 from 1.0	Micro Planner for Windows 6.0 $595 Upgrade, $100	Time Line 3.0 $595 Upgrade, $99
PRESENTATION				
Windows	●	○	●	●
No. of windows	Limited by memory	N/A	1	2
FILE IMPORT/EXPORT				
.DBF files	○ ●	○ ●	○ ○	○ ●
.WK1, .WKS files	○ ●	○ ●	○ ○	○ ●
ASCII files	○ ●	○ ○	● ●	● ○
Delimited ASCII files	○ ●	○ ●	● ●	○ ●
.DIF files	○ ○	○ ●	● ●	○ ○
SYLK files	○ ○	○ ○	○ ○	○ ○
HELP, DOCUMENTATION AND ERROR HANDLING				
On-line help available	●	●	●	●
Context-sensitive help available	●	●	N/A	●
On-screen tutorial	●	●	○	●
Explains error messages	●	●	●	●
Suggests remedy for errors	●	○	● (only on some errors)	●
TECHNICAL SUPPORT				
Cost of single-user support	$150/year after 6 mos.	Free	$100/year after 90 days	Free
Cost of multiple-user support	Varies; up to $75	Free	$100/user/year after 90 days	Varies from $100 to $150/user for 20 or more users

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable program does not have this feature

* Supports plotters with optional $195 graphics package

(ends)

tures could be better (there is no earned-value report, for one), and it allows too few resources per project. But if you want to model complex projects with the touch of a mouse, are wedded to the *Windows* environment, and have a mixed-hardware environment, *Micro Planner* is well worth your consideration.

Microsoft Project

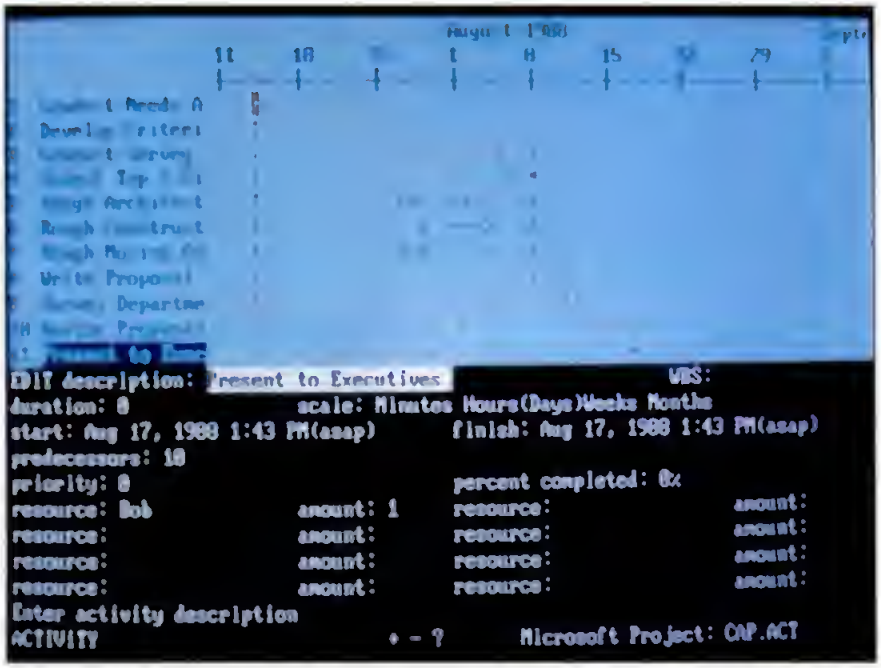
The cliché "ease of use" is unfortunately the most appropriate phrase to describe *Microsoft Project*'s major strength and, until recently, its major limitation. Although a series of command menus made Version 3.0 of the $495 program a breeze to use, its small supply of canned reports and limited customization abilities made it less flexible than some of its competitors. Version 4.0 of *Microsoft Project* remedies some of these and other limitations. Now you can have three different types of activity dependencies, and you can edit activities directly from the network chart. The new version includes a custom report writer, a form of resource leveling, a means of filtering data, and additional shortcut keys. The result is a program that is richer in features and functions than its predecessor and is still very good as a basic planner's tool.

As a testament to its simplicity, *Microsoft Project* offers the minimum number of screens and program commands that you would need to lay out a project. Ten screens show a Gantt chart or comparative Gantt charts, a network diagram, a resource table, daily and hourly calendars, single- and dual-resource histograms, a histogram with a Gantt chart, and a report form. Each screen has a menu of commands at the bottom. Different combinations of the 24 top-level commands offered by the program appear on the various menus, where their function is tailored for a particular screen. You can invoke most program functions by working your way through one or two menu levels and, if necessary, filling in some command fields. Because the range of screen views and commands is kept to a minimum, you will quickly feel comfortable using the program.

CLEAN SCREENS The design of *Microsoft Project*'s screens is also quite simple. Clean and neat, the screens don't have fancy borders, drop-shadows, pop-up menus, or dialog boxes. You can choose only background, foreground, and critical path colors from a list of 15 possibilities. The command menus, fill-in fields, and data-entry forms are white-on-black, as on a DOS screen. The only design flair in the program occurs in the tutorial, which at times uses as many as six colors on the screen and has title bars, double-ruled borders, and boxes.

Microsoft Project is simple on a functional level as well. A blank Gantt chart appears when you start the program. To enter tasks, you first press Enter on the already highlighted Edit command. The lower third of the screen is now filled by the activity entry form, where you enter a name, WBS (work breakdown structure) code, duration (scaled in minutes to months), start date, end date, predecessors, priority, percent completed, up to eight resources, and the amount of their use. That's all there is to it. You can continue to add activities one after the other by using the Cursor Down key to open up another blank form and move the cursor bar down the Gantt screen.

The WBS field, which can be used for sorting and filtering, is new to *Microsoft*



The Gantt chart is Microsoft Project*'s main planning tool. When you enter or edit task data, the Activity entry form overlays the bottom part of the chart. You can record eight resources for each task, as well as enter a WBS (work breakdown structure) code, set a priority, and indicate the percentage of work completed.*

Project. Being able to assign a WBS number lets you indicate how each activity fits into the hierarchy of the project. It is particularly useful when you want to look at different project phases. You can create a filter on various fields defined by specific criteria, wildcards, or a range. For example, you could select all activities occurring between October 1988 and January 1989 that have a WBS value of 1.2, use resources ending with the abbreviation "Eng" (for engineer), and have a slack-time range of 1 to 7 days. You can save and reuse filter routines by pressing the F5 key and using the highlight bar to pick from a list. After running a filter, you might sort the selected activities on as many as three levels. You can also sort and filter your resources.

Sorting is not new to *Microsoft Project*, but the ability to run a multiple sort is. The combination of WBS codes, filtering, and this enhanced sorting capability makes Version 4.0 a much more flexible program than its predecessor, especially during the tracking phase of a project, when you want to see or report on selected elements.

The other new field on the activity form is called Priority, which in effect provides automatic resource leveling. If you activate this function, it will resolve resource conflicts by pushing activity dates within their slack time. The priority number of 0 to 100 controls the order in which activities will be shifted—the higher-numbered activities are the first ones adjusted.

LEVELING CONSTRAINTS Microsoft's interpretation of resource leveling, while better than none at all, ignores real-world constraints. If a resource is overallocated, using slack time as a fallback is not an acceptable solution. By contrast, most automatic resource-leveling algorithms usually delay the end date of a project rather than use slack time.

You can now specify finish-to-finish and start-to-start dependencies on the activity form—along with lead and lag times—in the predecessor field. These new relationship types give you more control over activities and help you refine the planning process. Each activity can have up to 16 dependencies.

Microsoft has also improved the program's reporting capabilities. In Version 3.0 there were 16 predefined reports, some of which you could customize to a degree by specifying dates, activity numbers, or critical path. With one important exception—an earned-value report, which is important to government agencies—these reports covered a wide range of project information. Version 4.0 has seven new predefined reports and lets you do earned-value analysis. Equally important, it lets you truly customize reports in a tabular form, working from the Activity, Resource, or Analyze screens.

As you pick fields from the report form, they appear as column titles on the screen. Once you have selected fields, you can set margins and add up to three title lines. In this way you can build a simple earned-value report—simple because the program measures only percent of activity completion and ignores the actual percentage of money spent.

A more visual approach to tracking progress is looking at a planned versus actual schedule. *Microsoft Project* does a nice job of presenting a split-screen Gantt

PC MAGAZINE FACT FILE



***Microsoft Project*, Version 4.0**
Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, WA 98073-9717
(800) 426-9400
(206) 882-8080
List Price: $495
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: With minimalist screens and a terse command set, *Microsoft Project* is the simplest of the programs reviewed here. Its main project view is the Gantt chart. The program now offers resource calendars and does resource leveling, but only within the confines of float. You can customize reports in a tabular format. The program suffers from a weak PERT chart, an inability to track costs in detail, and the limited number of resources per task. But as a basic planner's tool it covers the bases and is very easy to use. Not copy protected.

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HARVARD PROJECT MANAGER 3.0: A MORE FREE-FORM APPROACH TO PROJECT PLANNING

With an innovative default approach to building schedules among its added features, the beta version of Harvard Project Manager refines the old and ushers in the new.

Harvard Project Manager 3.0 has followed the same developmental trajectory as its principal competitors in the under-$595 price range. By adding two new ways to build a project, outlining, and a hybrid of the Gantt and PERT (Program Evaluation and Review Technique) charts, Software Publishing Corp. is trying to accommodate a greater variety of users. At the same time, the company has strengthened the reporting, resource, and cost features of the program to make it even more appealing to experienced project managers.

The most interesting addition to *Harvard Project Manager* 3.0, which we looked at in its beta release, is Fast Track, the new default approach to building a project schedule. Its name announces Software Publishing's hope that it will give novice users a leg up to the world of planning.

FAST BUT FRIENDLY Fast Track represents a shift in emphasis away from the formal project creation techniques employed by *Harvard Project Manager* 2.0 and other programs, toward a more free-form, friendly approach. In *Harvard Project Manager* 2.0, the default approach to building a schedule was the work breakdown structure (WBS) chart. Its hierarchical picture of a project included a host of dummy milestones that cluttered the screen. In addition, the algorithm Version 2.0 used to translate a WBS chart into a PERT chart was poor. Sometimes the PERT needed extensive editing before it made any sense at all. The translation scheme has been improved in Version 3.0, but still better, the Fast Track method offers a much simpler approach to project building.

The Fast Track screen is split into three areas. Across the top is a time scale, which you can change to represent minutes, days, weeks, or months. A zoom command lets you display two or four times as much of a time scale on-screen at once. The main area under the time scale is devoted to tasks. There is also a column set aside for notes.

You enter tasks by moving the cursor to a date position and typing its name. As you start to type, the "Add task" box pops up and the name is filled in. When you enter the duration of the task, a thin line appears on-screen, its length reflecting the duration of the task. The task name appears in the middle of its line.

The way you enter and move tasks is similar to using a word processor. Tasks entered on the same line must follow each other sequentially. If tasks are entered under each other, then they must occur at the same time. Using control keys, you can lengthen or shorten a task line or move it to another position.

As you enter tasks using Fast Track, you automatically prefigure their relationships, in the same way you would on a PERT chart. Still, you have to establish formal dependency links between tasks through a fill-in box. Since task lines show duration and position in time, Fast Track diagrams also have Gantt chart characteristics.

If Fast Track is the program's most interesting feature, outlining may come to be its most-often-used one. *Harvard Project Manager*'s outlines look like normal text outlines. You create different levels by placing task names under each other and indenting them. Although you can have up to 99 levels—enough for almost any project—only ten can be displayed on the screen at once; the rest are indicated by a level number. The level number and WBS code are automatically generated by the program, but you can change them. You can hide or reveal outline levels, making it easy to summarize project phases or to concentrate your planning efforts on one piece of a project. Alongside the task names there is room for up to 15 columns of data. These may include planned start date, planned duration, percent complete, actual finish date, and actual total cost, among others.

Although Version 3.0 has taken a fresh, new approach to building project schedules, the basic screen design and chart that shows the Forecast schedule on the top half of the screen and the Actual schedule below it. Inconsistencies between the two schedules are very obvious.

UPDATING DUO The program offers two ways to update a schedule—automatically or interactively. In *Microsoft Project,* Version 3.0, all updating was automatic. This made tracking almost effortless, but it assumed that activities progressed as time elapsed, which, of course, isn't always the case. Interactive updating is much more effective for tracking the daily progress of a project.

Some other features found in *Microsoft Project* 4.0 are the ability to edit activities without leaving the network diagram, a comparative histogram for two resources, a half-dozen shortcut key combinations for switching between screens, plotter support, and new graphic printouts.

The main failings of the program are its weak PERT chart diagram, the small num-

operational approach of the program have not changed. The screens have the same snappy design as Release 2.0. They use attractive color combinations, drop-shadows for boxes, and window titles with rule lines under them. You'll still find program commands on pull-down menus and invoke them by pressing function keys. You issue other commands by using the cursor keys and then pressing Enter, by typing their menu number, or by using a Ctrl-letter combination.

You enter project information into fill-in-the-blank boxes and forms. Extensive on-screen help linked to both fields and menu options prevents you from getting lost. If a help message doesn't answer your question completely, you can go directly to the help index. Reminders and warnings often appear at the bottom of the screen. With all the menus, hints, prompts, and help, *Harvard Project Manager* is easy to operate.

VERSATILE REPORTS A corollary to ease of use is flexibility, and Software Publishing has certainly added flexibility to the reporting facilities. Now you can create report templates for the 26 different report types in the program. Some report possibilities are a task work summary, allocations by resource, earned value, a PERT chart, and a cumulative cost graph. In a template for a textual report you get to select column headings and their order, data values and ranges, and the sort pattern. In the graphic reports, your template can include the orientation, the colors, print quality, and whether or not to show a time scale grid. You can also scale a graphic report to any size between 10 and 200 percent of the normal size. For both types of report, your template can include such items as headers, footers, and a filename.

You can build a template first and then run it as a report, or you can run a report and then save it as a template. You're allowed to store up to 50 templates in a directory. They can easily be edited if report designs change or be deleted if they become obsolete. Version 3.0 also lets you build a batch file to print a series of report templates, making standard weekly reports a breeze to produce.

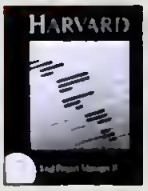
Software Publishing has extended *Harvard Project Manager* in several other ways as well. The inclusion of separate resource calendars lets you control resource availability much better than you can with a single project calendar. You can specify individual work hours, personal days off, and vacation time or downtime for regular maintenance. Another new feature is data import. Now you can pull in resource or cost data from ASCII, delimited ASCII, *Lotus 1-2-3*, and *dBASE* files.

Still another new feature is the ability to add penalty costs to the project model, so late penalties can be taken into account in cost tracking. The program's support of extended memory can reduce calculation time by 50 percent. And if you have a VGA monitor, you can display 43 lines on the screen rather than 25.

The changes Software Publishing has made to *Harvard Project Manager* will certainly increase the program's appeal to people who are unfamiliar with project management techniques and concepts. Yet veteran planners will also find added functionality in the product.

—Henry Fersko-Weiss

FACT FILE



***Harvard Project Manager*, Version 3.0**
Software Publishing Corp.
1901 Landings Dr.
Mountain View, CA 94039
(415) 962-8910

List Price: $595

Requires: 512K RAM, hard disk, DOS 2.0 or later.

In Short: Version 3.0 of *Harvard Project Manager*, reviewed in its beta release, eliminates quite a few of the faults of its showy predecessor, *Harvard Total Project Manager* 2.0. No longer is the planning emphasis on WBS chart and the PERT diagram. Now, two new, more-intuitive approaches are the main planning tools: outlining and Fast Track, a hybrid Gantt and PERT chart. The program can indicate penalty costs, has individual resource calendars, and lets you create customized report templates. It is easier for novice planners to use and is richer in functionality than the previous version. Not copy protected.

CIRCLE **674** ON READER SERVICE CARD

ber of resources it allows per activity, and its limited resource-leveling capabilities. Still, such powerful new features as a custom report writer and a WBS field, combined with its simplicity, make the program a good choice for newcomers to project management who need to get up to speed in a hurry.

SuperProject Plus

Computer Associates International's *SuperProject Plus* is an extremely flexible program, rich in ways to view a project. In addition to the Gantt and PERT charts and the task and resource detail screens in earlier releases, Version 3.0 has an outline screen, a WBS (work breakdown structure) chart, and a resource histogram. Each screen also has alternate views. For example, the task Gantt chart can be seen in outline form—with or without resources shown—or as a basic task chart. *SuperProject Plus* 3.0 also inherits and extends the operational pliancy of earlier versions with new preference settings for things like

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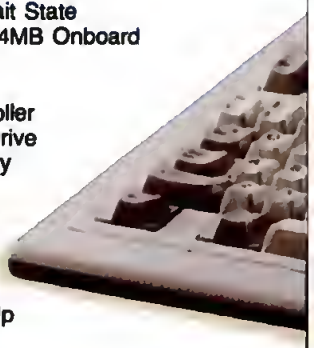
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SuperProject Plus*'s resource Gantt chart shows a resource histogram on the bottom of the screen and a Gantt chart above it, displaying only the tasks to which the resource is assigned. The red bars in both charts indicate the critical tasks. To the left of the histogram, a box shows available work hours and units for the resource.*

evaluation diagnostics and "must" dates. Other enhancements include the following: a new menu system using slash commands as in *Lotus 1-2-3;* extra schedule types, such as "as late as possible" (ALAP); control over the column order in reports; and the ability to print Gantts for a specified date range. Even the price has been improved: at $395, Version 3.0 is $100 cheaper than its predecessor.

SuperProject Plus is a subset of a higher-end project management program sold by Computer Associates International called *SuperProject Expert*. The $695 program contains all of the basic operations you'll find in *SuperProject Plus*, as well as maintaining the same screen designs. But for $300 more, you'll find such additional features as use of selection criteria on the outline display screen; the ability to import *SuperCalc*, *Lotus 1-2-3*, and *dBASE III* files; network capabilities; macros for automating operation; three modes of use—beginner, intermediate, and expert; resource smoothing within allowable float; PERT duration probabilities; round-the-clock shift scheduling; several new report types; and plotter support.

As with several other programs in its price class, the most fundamental change to *SuperProject Plus* is the introduction of an outline approach to planning. While the program opens to the PERT screen, it's much easier to build a project using the outline view. Not only can you see more tasks on the screen at once, but the overall project structure is more clearly evident. As an acknowledgment of the virtue of outlining, Computer Associates International's 10-Minute Guide to the program demonstrates how to enter tasks and resources on the outline screen.

The outline screen is divided into columns. On the far right you enter the names of project phases, tasks, and resources. You indent sublevels of the outline by using the Shift–Cursor Right key combination. Summary tasks are marked in yellow; detail tasks are in white. *SuperProject Plus* uses color effectively throughout the program, helping you quickly grasp the significance of different kinds of information. You can have up to nine outline levels, which should be sufficient for most small to medium-sized projects. The other columns on the outline screen are: Task ID, priority, duration, scheduled start and finish dates, resource allocation type (how hours are calculated), resource units, and finally the total hours.

INTEGRATED VIEWS All of the program views are tightly integrated. If you build a project using the outline screen and then decide to switch to a Gantt chart, task bars stretch out in red and blue underneath a time scale in days, weeks, or months, and task levels follow the same indentation scheme as they did on the outline screen. You can move from one view to another in several ways. You can type a slash and then select a function from a pull-down menu, or simply type the initials of the command you want after the slash. The third and fastest approach to switching views is to use an Alt-number key combination. These command strategies are available throughout the program, giving you a way to increase your speed as you become more familiar with using the program.

SuperProject Plus 3.0, like its earlier versions, offers a number of different skill levels. It comes set for beginner mode, but

EDITOR'S CHOICE

PC MAGAZINE

FACT FILE



***SuperProject Plus*, Version 3.0**
Computer Associates International Inc.
1240 McKay Dr.
San Jose, CA 95131
(408) 432-1727
List Price: $395

Requires: 384K RAM (512K RAM recommended), two disk drives, DOS 2.0 or later.

In Short: *SuperProject Plus* gives you many views—including charts, graphs, and detail screens—of your project. The program now uses slash commands and outlining and offers both beginner and intermediate modes. *SuperProject Plus* has terrific calendars and partial-resource assignment capabilities, flexible cost-accrual features, and good resource-leveling and custom-reporting abilities. It could have a better Gantt chart and be more adept at handling multiple projects. Not copy protected.

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you can switch to intermediate mode by pressing Ctrl-I at the Preferences screen. The two modes can be mixed by turning on and off various preference settings. For example, you might want to leave Auto Recalculation turned on, as in the beginner mode, and yet turn off Confirm Delete, as in the intermediate mode. One of a few new preferences in Version 3.0, the Must Override Precedence option, lets the program ignore precedence links when a task's Must Start date is earlier than its calculated Early Start date.

Dates for tasks are based on durations, priorities, resource availability, float times, and so on. Many of these calculations depend on a calendar. *SuperProject Plus* has exceptional project and resource calendars. On the project calendar you can indicate the start time of the work day, the time for the main break, the daily work hours, and holidays, which can be named. The resource calendars look like the project calendars, except the number of units and standard work-day hours are displayed on the top, and personal days off are indicated in red text, while company holidays are in blue. In both calendars, you can adjust work hours for individual days by entering a number on the date box.

■ *SuperProject Plus* has exceptional project and resource calendars for task calculations.

While working with the calendars, you can call up two special "view windows." One details schedule and resource information for a highlighted date; the other has cost information. The view alternatives give you a fast way to see additional, related information, or to change the screen in a way that might make it easier to read. For example, one of the views on the Outline screen reveals task and resource notes (up to 53 characters per note). One of the WBS view windows flips the chart from a horizontal to vertical orientation. The view windows, accessed by pressing Ctrl-V, give the program a sense of visual opulence.

STRUCTURE AND SCHEDULING In addition to the outline screen, the program has two other new screens: a WBS chart and a resource histogram. The WBS chart is a graphic translation of the outline. It shows the structural relationship of tasks in a project. The resource histogram is an important addition because it's the best way to see exactly how overscheduled or underscheduled a resource is. *SuperProject*

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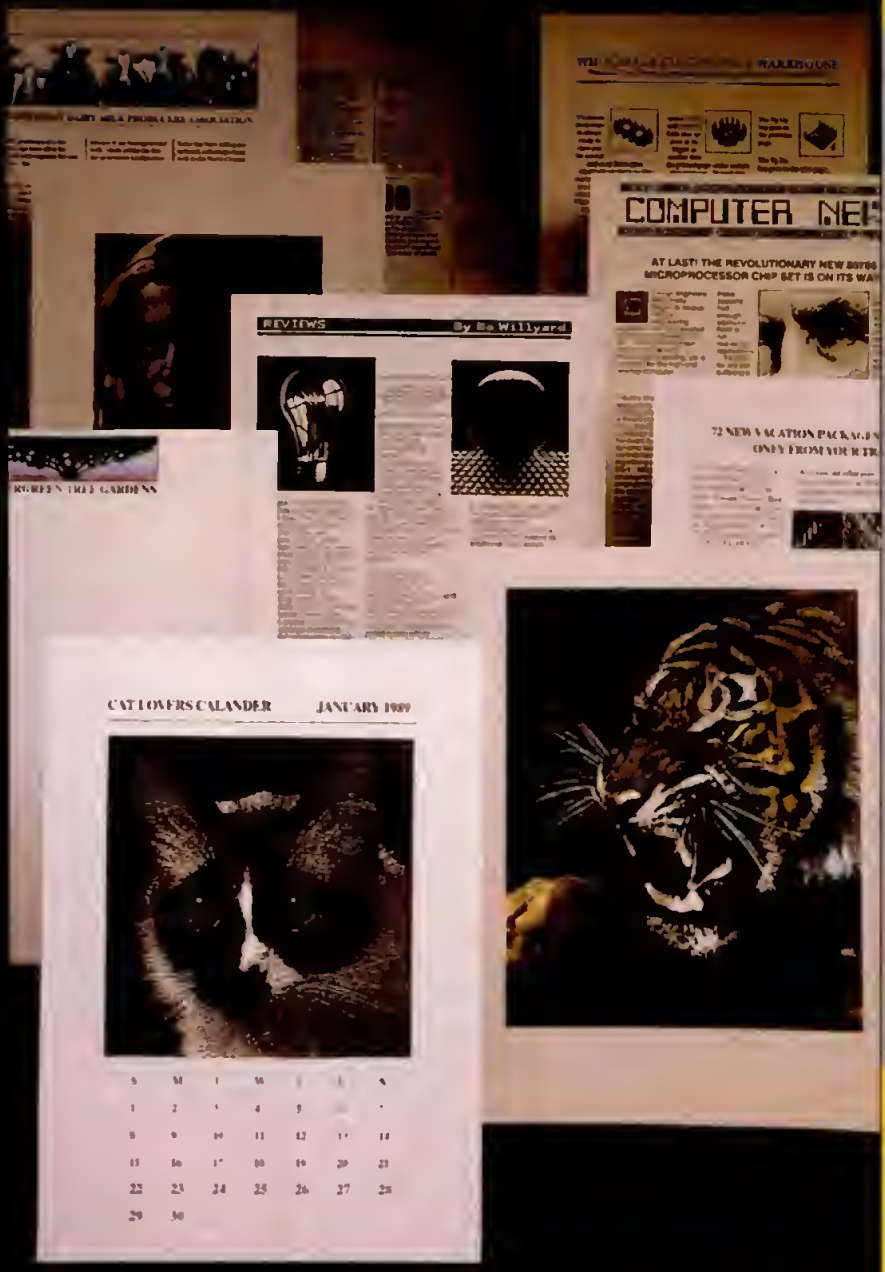
Plus's version is a split screen showing a Gantt chart for the tasks a resource is assigned to on the top, and a vertical bar chart for the resource's workload on the bottom. If a resource is overallocated, the bar extends above the maximum line in red and it flashes, just like the task bar in the Gantt chart.

SuperProject Plus's resource histogram is especially useful because it affords you a great deal of precision in allocating resources. You can assign a resource for a full day of work, *N* hours a day, or *N* percent of a day over the duration of a task; or you can assign a resource in the above ways until it has spent a certain number of hours or days on a task. Similarly, you can specify how costs are to be applied. They can accrue at the start or finish of a task, or be prorated for the duration of a task.

SuperProject Plus has two ways of doing automatic resource leveling if resources are over-allocated. One approach delays tasks in order of their available float time first and then turns to task priority settings. The other approach works in reverse, looking at priority settings first. This second approach gives you a much better way of viewing and handling tasks that are delayed. You can see the effect of resource leveling on the Gantt chart. A delayed task is represented by a bar comprised of little green arrowheads. The length of the line equals the amount of the delay. Resource leveling does not work across subprojects, which makes planning multiple projects that much harder.

By entering the actual start and finish dates, hours worked, and actual costs after the real project is under way, you can compare your project with a baseline plan. The status of a task—Scheduled, In Progress, Interrupted, or Completed—appears on a Gantt chart under the task name or resource. You can also see an actual-versus-planned Gantt chart with the two task bars displayed one on top of the other. If the actual hours worked will push a task duration past the planned end date, the words "Late Finish" will appear under the task name.

15 POWERFUL REPORTS *SuperProject Plus*'s reports are a powerful part of its project-tracking facilities. There are 15 report types that you can vary to generate 27 different reports. In addition, because you



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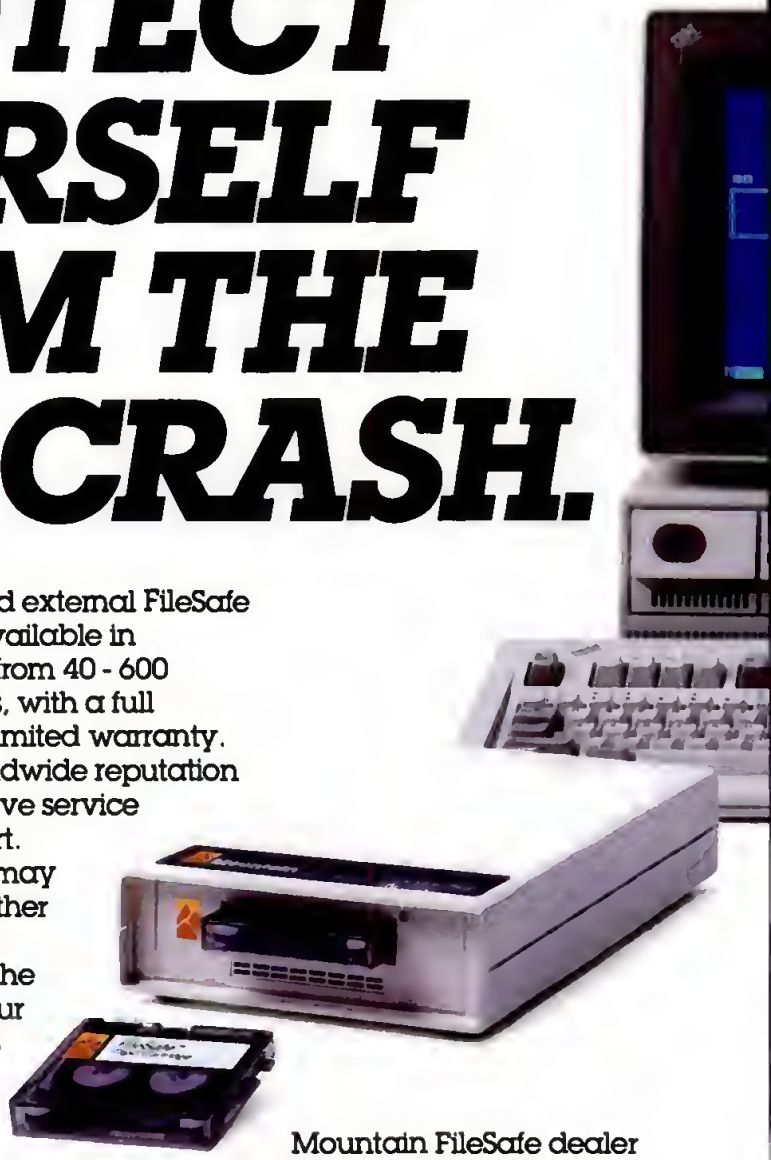
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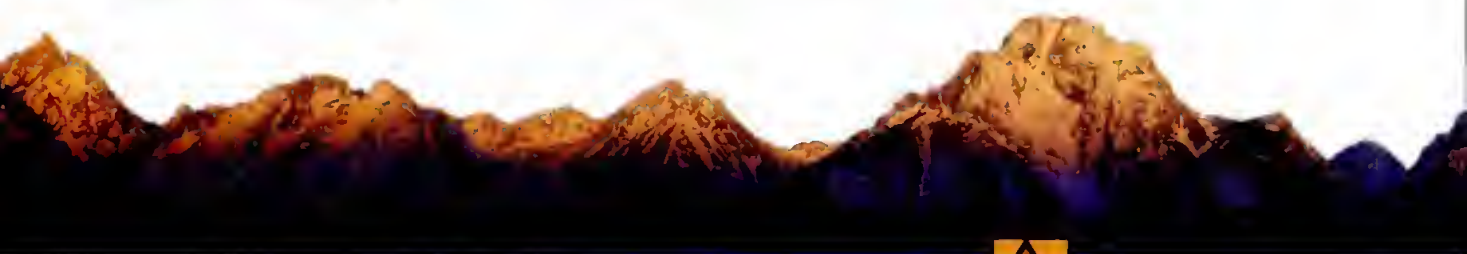
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can pick report fields by exact values or within a range of values and apply selection criteria using Only, And, Or, and None, you can tailor your output to your needs. You can sort your data by up to three levels, and you can specify the column order. You can also name your various criteria selections and save them for repeated use.

SuperProject Plus's failings are few. Perhaps the most important are its relegation of multiple projects to subproject status and its inability to level resources across these subprojects. The Gantt chart could also be better. Because the task bars sit one on top of the other, with no spacing between them (if the dates overlap), it can be difficult to quickly grasp the meaning of the bar pattern. Also, the note field is limited, and tasks and resources can't be scheduled in minutes.

■ Time spent to learn how to use *SuperProject Plus*'s many features is worth the extra effort.

Although you'll have to spend a considerable amount of time to learn how to use *SuperProject Plus*'s many features, it's worth the extra effort. Well-rounded and flexible, the program offers a multitude of ways to view a project at a multitude of skill levels.

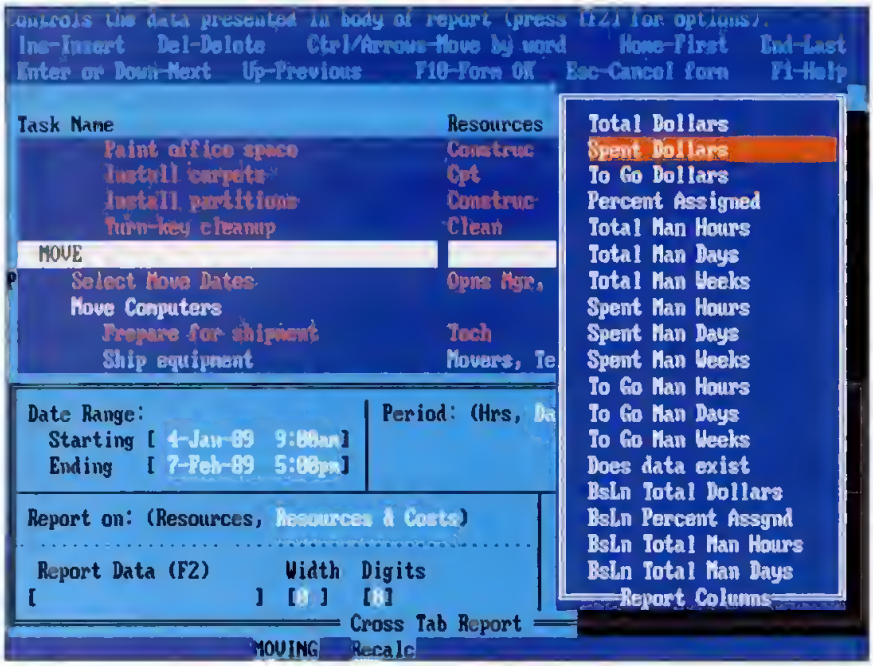
Time Line

Time Line, Version 3.0, is the first new version of Symantec Corp.'s product since 1985. This is a long period of stasis for a program—even one as excellent as *Time Line* 2.0. But at least the last 3 years have been productive. *Time Line* 3.0, which costs $595, is even more versatile and easy to use than its predecessor.

One of the most important changes to the program is its use of outlining as a planning tool. It gives users a familiar and logical way to organize projects. In addition, the new version lets you customize the nongraphic information on Gantt charts and enter tasks from PERT charts. *Time Line*'s reporting function is now more flexible, scheduling can be effort-driven as well as time-driven, and there are additional command shortcuts, expanded notes, and more. The changes are so extensive that you need 640K RAM to run the program as opposed to the 256K RAM you needed for Version 2.0.



CIRCLE 531 ON READER SERVICE CARD



Reports created with Time Line, *such as the cross-tab report displayed here, can be saved as layouts and then reused. Pop-up boxes overlay portions of the outline screen. On the bottom of the screen is a report form, and on the right is a box for selecting column data.*

Time Line opens to an empty Gantt chart. The Slash key brings up a *Lotus 1-2-3*–like menu across the top of the screen. You select commands by using the cursor keys or the highlighted first letter. You can use QuickPick, another hotkey approach, to select task, resource, or layout lists. If you want to jump quickly to a resource starting with the letter *W*, such as an employee whose last name is Webster, you begin by pressing W, which brings up a list of all resources beginning with that letter. As you continue to type succeeding letters, the list is reduced, until finally your resource is selected. Since a typical project can consist of 1,000 tasks or 300 resources, you can save a lot of time by using QuickPick.

Time Line's 27 shortcut key combinations also speed up the selection process. Using the function keys alone and together with the Shift, Ctrl, and Alt keys, you can pull up a network view of your project, recalculate the schedule, show task dependencies, and so on.

Symantec's care in designing the program shows in such elements as pop-up boxes for help and lists of tasks and resources. Screens are cleanly laid out and use color effectively; error message boxes, for example, have red backgrounds. The manual is a pleasure to read, with side-margin hints, discussions on planning, and screen illustrations. Also, there is quite a good on-screen tutorial.

Most project information gets entered on forms. There are forms for tasks, resources and costs, the layout of the Gantt chart, file information, schedule options, and the calendar, among others. The forms use a combination of multiple-choice and fill-in-the-blank fields. Context-sensitive help is available for every field. The help is thorough and informative on planning techniques. For example, if you press F1 at the Keyword field on the task form, you are prompted to enter a word or a number to identify a group of related resources. The use of keywords is explained with an example.

GANTT CHART OUTLINE *Time Line* 3.0 uses outlining as a project organization technique. You can create a task outline directly on a Gantt chart, which is the central graphic view of a project. To do this you indent sublevel tasks, as you would in a normal outline. Indented tasks become children of the parent task that sits above them, which means that their costs and duration are aggregated at the parent level. If there are more than two levels, everything indented under a top-level task is known as a family. You can have as many levels as you want. On the Gantt chart itself, parent or summary tasks are represented by a bar composed of three broken lines. In contrast, detail task bars are solid. Summarizing costs and durations helps you to think about a project in manageable chunks or phases.

You can open or close task outlines at any summary level using the Plus and Minus keys. If the whole outline is closed, only the top-level summary tasks will be displayed. Closed-up levels are indicated by a plus sign to the left of the task name. Selectively opening and closing levels helps you focus your attention on specific aspects of your project. This is particularly important, since you can see only 19 tasks on the screen at once. Hiding and revealing task groups is also useful for presentations and reports.

The Gantt chart in *Time Line* is split into two areas. On the left side of the screen

EDITOR'S CHOICE

PC MAGAZINE

FACT FILE

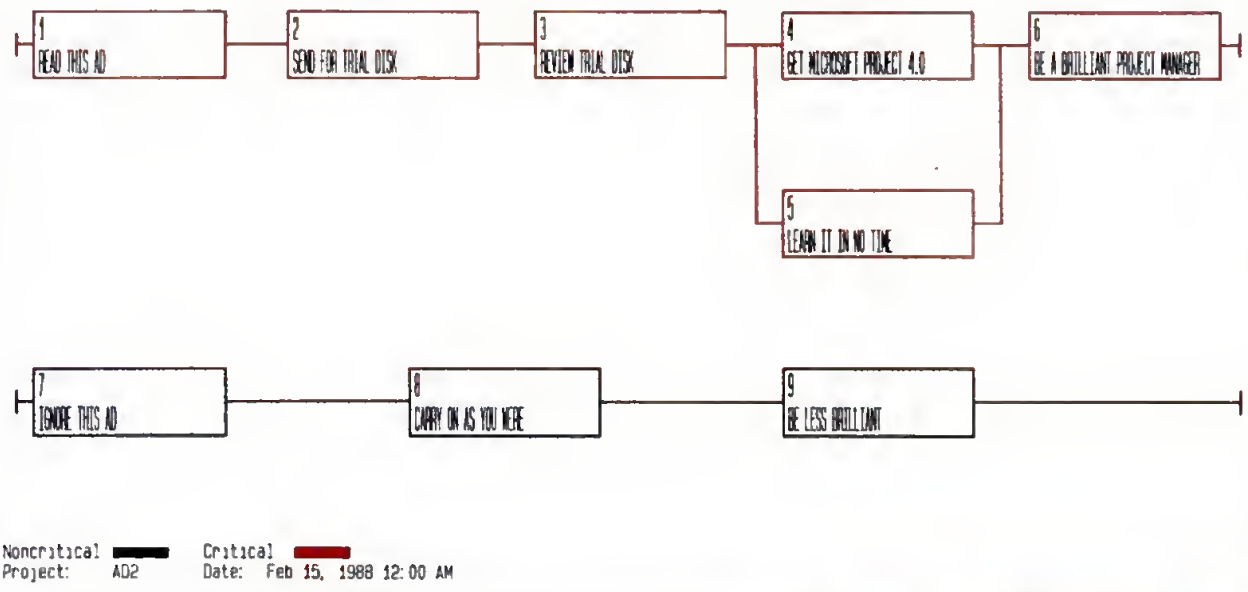


***Time Line*, Version 3.0**
Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
(408) 253-9600
List Price: $595
Requires: 640K RAM, hard disk, DOS 2.0 or later.

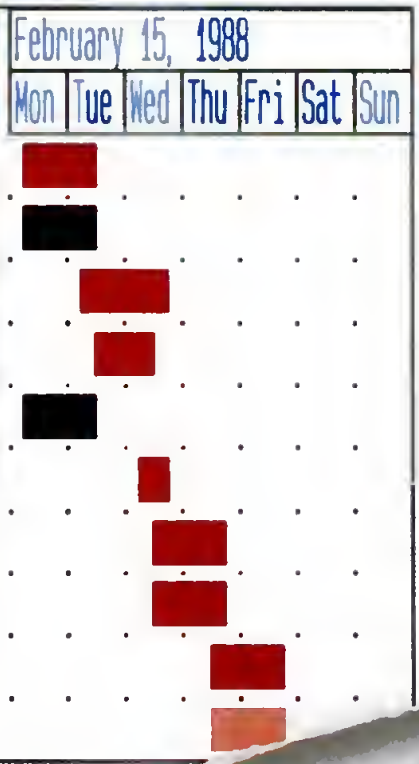
In Short: The first new release after a 2½-year hiatus, *Time Line* 3.0 offers such new features as outlining, a customized Gantt chart with up to 16 data columns, more-flexible reports, effort-driven scheduling, earned value measures, an extensive note facility, and much more attractive screens. Operations can be speeded up with new shortcut commands, initial letter selection, an Undo/Redo feature, and reusable layouts. Its failings are a poor PERT chart, lack of resource calendars, and the need to buy an add-on package for good graphics. Not copy protected.

CIRCLE 670 ON READER SERVICE CARD

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5	Resource Views: Adjust Scheds/Resources
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you can list the task names followed by columns of task data. On the right side are the task bars indicating the duration and relative position of project activities. You can customize the Gantt chart by choosing from over 60 different data columns, and you can even eliminate the task bars to show a tabular summary of a project. The data column choices include cost, start date, end date, resources, status, duration, and so on. But only 16 task columns can be displayed at once. You can save and recall Gantt chart layouts to change the data view. Having this much control makes planning and tracking much simpler.

If you are starting a new schedule, you can use the combine feature to copy tasks, resources, layouts, a calendar, or other project pieces; to use a schedule template; or to follow an automated routine. This last method, the Schedule/New command, is excellent for first-time users. It displays a series of forms in sequence and prompts you to define a calendar, resources, and schedule options.

When entering task or resource information, you can use a macro feature to duplicate repetitive data. For example, if a series of tasks taking one day each will use the same resources, you can enter this information for every task after the first one with one keystroke combination, Alt-P. But you can record only one macro at a time and it can't be saved, severely limiting its usefulness. However, Cybersoft, a San Jose, California–based vendor, has written a full-blown macro package for *Time Line*. It retails for $195.

One of the fields on the task, resource, and a number of other forms is reserved for notes. In *Time Line* 2.0 this field was restricted to two lines. In Version 3.0 you can have up to five screens of text for a task. This additional space is valuable for recording peculiarities of a task or resource and for maintaining telephone numbers and follow-up reminders. A Journal feature lets you keep notes on the entire project in an outline format.

TASK LENGTH AND TRACKING In *Time Line* 2.0, task durations could be entered only as units of time, such as 3 weeks, 2 days, or 1 minute—no matter how many resources were assigned to it. In Version 3.0 task durations can be entered as work efforts, such as 3 man-weeks or 100 man-hours. The nice thing about this feature is that *Time Line* will calculate the length of time a task will take, based on the number of resources allocated to the task and the percentage of time they are working on the task.

Another of *Time Line*'s new additions is a task-tracking form. It has all the fields on the regular task form, plus two coding fields to identify task and resource groups, a field to denote priority tasks, a link field to summarize other schedules into a single task within the present schedule, and an achieved field for monitoring how complete a task is by percentage. You can make the tracking-task form the default or access it by pressing Ctrl-F2.

As you build a project schedule by adding tasks and resources, you may want to see how alternate scenarios would affect it. *Time Line* 3.0 has an Undo/Redo feature similar to those you'll find in many spreadsheets—but it allows you to store and retrace from 1 to 99 steps, making it a good "what-if" tool.

To further refine a schedule, you can display up to five resource histograms at the bottom of a Gantt chart to reveal resources that are overallocated. You can

PC MAGAZINE EDITOR'S CHOICE

- **SuperProject Plus**
- **Time Line**

The five project management programs evaluated here offer a lot of flexibility for the money; all are capable of helping you gain more control over your projects and resources, and all have gone a long way toward making the practice of project management more accessible to a greater number of users.

Of this group, two programs are especially interesting. Computer Associates International's SuperProject Plus, *Version 3.0 ($395), costs $100 less than its predecessor but offers more ways to view a project, among them Gantt and PERT charts, an outline screen, a WBS chart, and a resource histogram. The program has two skill levels, allowing beginners to get as much out of it as skilled project planners. Adding flexibility are 15 report types that you can customize to create 27 different reports, and two methods of resource leveling. If you like* SuperProject Plus*'s approach to project management but need such options as macros and the ability to import files from other programs, consider spending an additional $300 for Computer Associates International's* SuperProject Expert, *a $695 superset of* SuperProject Plus *that offers those capabilities as well as additional report types, network capabilities, and plotter support.*

Unlike SuperProject Plus, *the newest version of Symantec's* Time Line *($595) is $100 more expensive than its forerunner, which was a past Editor's Choice (see "Master Plans: Project Management Software,"* PC Magazine, *September 29, 1987). That additional $100 buys a lot, however. Even easier to use than its antecedent, Version 3.0 uses outlining, provides more-elastic reporting capabilities, has more room for notes, and offers 27 shortcut keys for issuing commands. You can still schedule tasks right down to the minute, but now you can enter task durations not only as units of time but also as work efforts. A macro feature, which automates repetitive tasks, and an Undo/Redo command, which is useful for performing what-if analyses, round out the package, making* Time Line *a stellar performer in the under-$600 category.*

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■ RANDOM Information

Did you ever realize that over half the information you deal with every day is the RANDOM type? Not databases—not spreadsheets—not long documents—but the information scattered around your workplace and in your head. Yet amazingly, until now there was no great software to help you—the tools were either too structured or without organization. But now, at last, there is a quick and easy solution—Tornado—acclaimed by rave reviews and accepted by corporations nationwide. Whether you are a business executive, consultant, engineer, or in any other profession, you need Tornado—it will save you endless time and effort every day—guaranteed—or your money back. Here is how it works:

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With Tornado, you process information in stacks of superfast "intelligent" windows—several on your screen at once. You type into the windows; interconnect and prioritize them; and scan through them in remarkable ways.

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manually change the allocation of resources or use the program's resource-leveling facility to resolve conflicts. This procedure will delay tasks to accommodate resources and thus will extend the project end date.

When a project has finally been built, the tracking phase begins. Here, too, *Time Line* 3.0 offers improved functionality. With the new tracking form, you can update a project with actual resource efforts, costs, and the percentage of completion. You can now display a baseline schedule with the schedule of a project in progress and, thus, have an actual-versus-planned Gantt chart. The baseline task bars appear as a series of O's under the actual task bars. With the baseline visible, it is easy to see lags in the project schedule. A built-in alarm clock reminds you to regularly update your schedule by alerting you to tasks that should have been started or finished since the last update.

Because you can display task data columns on a Gantt chart, you can choose to see a number of performance evaluation measures alongside the task bars. These measures include the budgeted cost of work scheduled (BCWS), actual cost of work performed (ACWP), budget at completion (BAC) (all of which are statistics required by government agencies), duration as percent of baseline, schedule variance percentage, and more.

At the heart of project tracking are *Time Line*'s report facilities. With the use of selectable task data columns on the Gantt chart, and improved filtering and sorting functions, you can generate a nice variety of customized reports. The outline structure also helps because it lets you do summary or detail reporting at various levels. There are five basic report types: Gantt, status, cross tab, resource, and network. Customized report formats can be copied from one schedule to another.

Even with all these useful additions, *Time Line* 3.0 has its failings. You are allowed only one calendar per project. Costs are prorated over the duration of a task, so you can't choose to front-load or back-load the costs. Also, the network or PERT diagram is still below par. Although it has been improved, its use of large boxes to indicate outline levels makes the chart visually complex. Finally, you shouldn't have to buy an additional package at $195 to be able to plot your graphs.

In the final analysis, these imperfections are minor when compared with *Time Line*'s fine, abundant features. With its ease of use and flexibility, it is an excellent choice for both novice and experienced business planners. PC

Henry Fersko-Weiss is a free-lance writer based in Warwick, New York. He is a regular contributor to several national publications.

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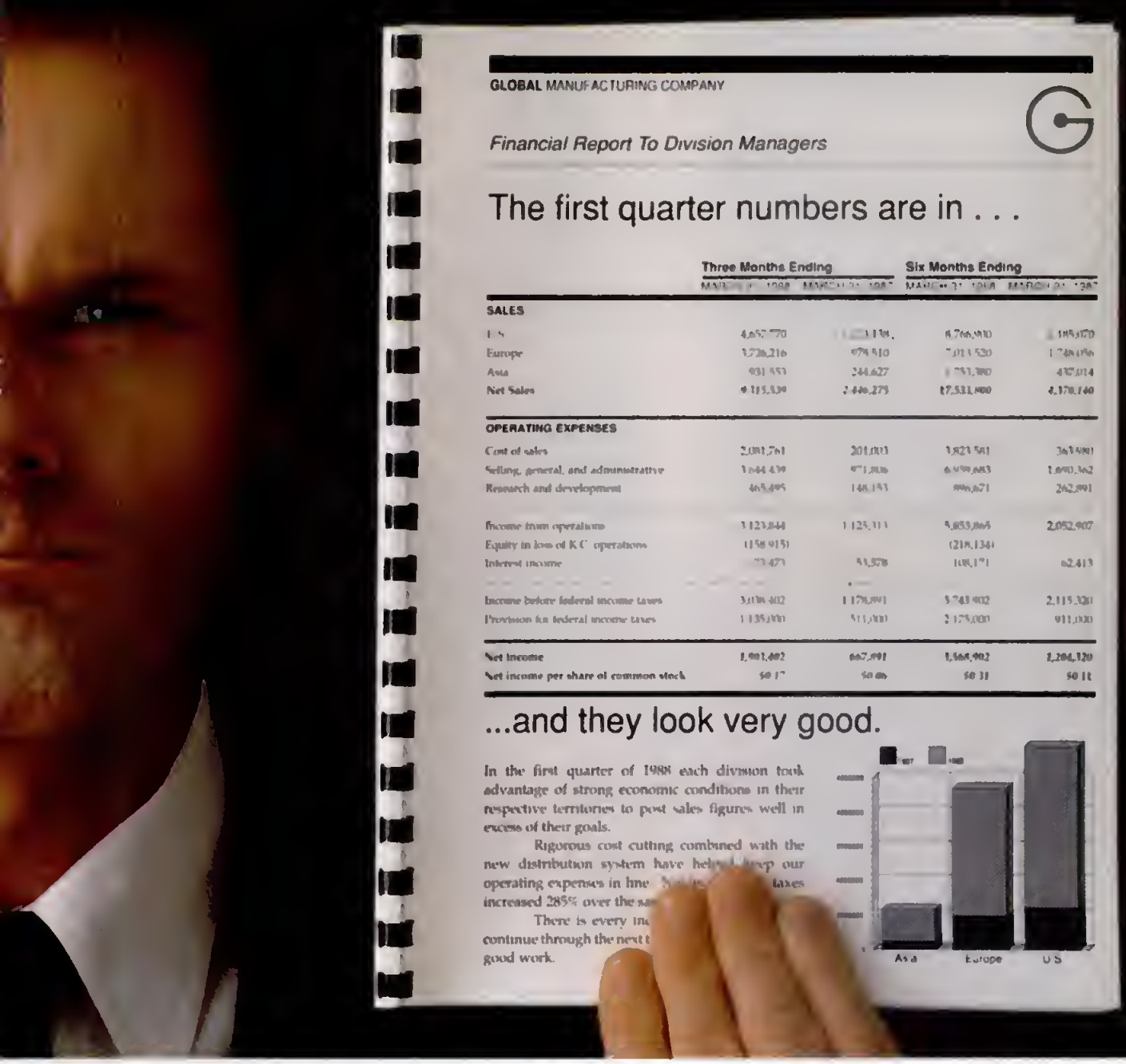
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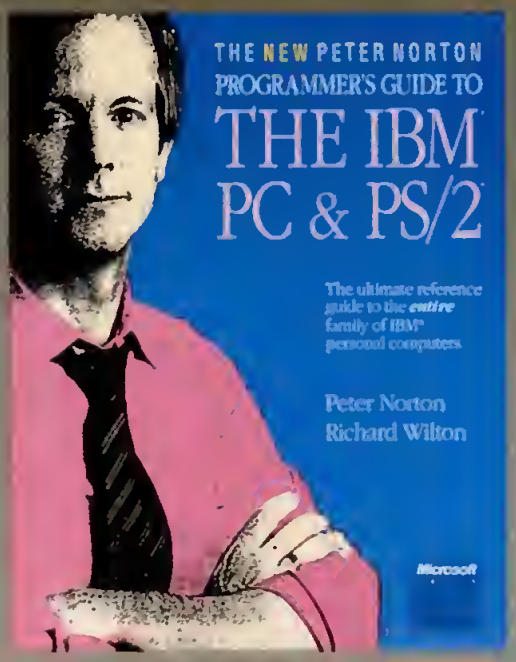
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Peter Norton's Best

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MAKING CONNECTIONS

Programmable Databases for LANs

Neat trick, handling simultaneous bids for data on a LAN. These 20 programmable databases can help—either by relying on DOS's data-locking services or by enlisting the more elegant log file architecture.

FRANK J. DERFLER, JR.

By far the most difficult function of a local area network is giving people access to the same data files at the same time. Compared with that complex task, the other two primary functions of a LAN—file transfer and equipment sharing (primarily printers)—are a breeze.

When several people share a file at the same time, some level of software must arbitrate simultaneous demands for the same data. Having several applications read the same data at the same time is OK, but reading data while another application is writing it can lead to inaccuracy at best and a crashed program at worst.

Before the release of DOS 3.0, LAN software designers had to put routines that controlled data access into the network operating system. Unfortunately, these routines and their use weren't standardized among manufacturers. To work with a specific LAN operating system, you had to buy a customized version of a database product. Often the right DBMS was not available for your chosen LAN operating system.

DOS DOES IT Microsoft helped alleviate this situation when it introduced DOS 3.0, which added commands like ATTRIB, LASTDRIVE, and SHARE for multiuser applications. ATTRIB makes files read-only to protect them from being changed or erased. LASTDRIVE is a CONFIG.SYS statement that tells DOS to make more drive designations available; these designations are linked to resources on a server. The SHARE command invokes the file- and record-locking capabilities DOS provides,

which we will describe below.

When Microsoft added these capabilities to DOS, companies that don't use DOS on the network file server, like Novell and Banyan, added emulation of the DOS data-locking services into their operating systems to stay compatible. When DOS on a workstation locks data on a Novell or Banyan server, the unique operating system in the server responds just as if it were DOS.

DOS 3.3 added other functions useful for LANs: APPEND, FASTOPEN, and SET HANDLE. While APPEND is a command that few people seem to use, it's certainly valuable on networks. It tells DOS where to search for data files in the same way that PATH tells it where to search for program files.

A few LAN operating systems, like IBM's *PC Local Area Network Program* (*PC LAN*, for short), use FASTOPEN to improve performance. Indeed, *PC LAN* *requires* DOS 3.3 for this reason. Issuing the FASTOPEN command causes DOS to cache filenames for faster response. People using DOS-based operating systems such as *10NET* and *ViaNet* will benefit from including FASTOPEN in their server's AUTOEXEC.BAT file.

SET HANDLE, another CONFIG.SYS statement, tells DOS to set aside space for more open filenames. In 2 years of LAN testing, we ran into only one instance where DOS reported "Out of file handles," but this could be a problem when several workstations run complex applications on the same server.

All these DOS commands and statements are useful when multiple stations share a server. But other features of DOS 3.*x* become critical when these same stations try to share the same data file.

If you don't plan to let people share data files, you can run any application program on a LAN; an application program doesn't have to be specially designed to run on a LAN. The only thing that might keep a program from running in a LAN environment is a copy protection scheme.

Ordinarily, the easiest way to use a program on a network is to use ATTRIB to make the program's .COM, .EXE, and .OVL files read-only—and to give each user a private subdirectory to store data files. In this way, all others on the network can use the application program while keeping their own separate data files. If they want to exchange files, it's easy and fast to copy them from one subdirectory on the server's hard disk to another.

LIKE A LIBRARY BOOK Things get more difficult, however, when you want to share the data files among many people at the same time. Let's first consider the case

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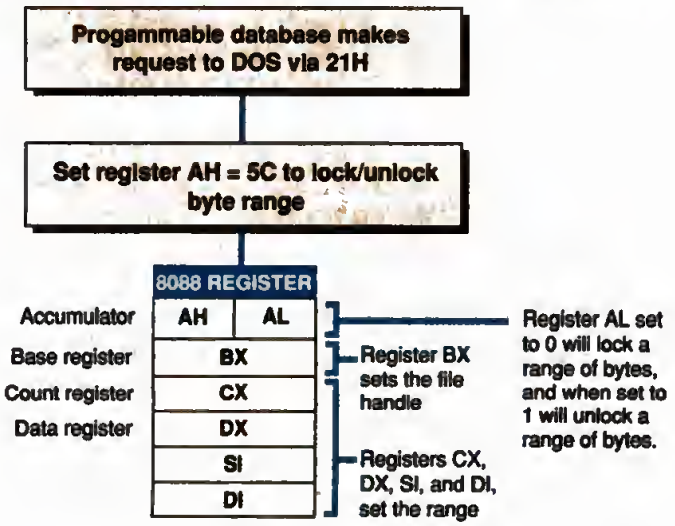
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How an Application Locks and Unlocks a Range of Bytes

The programming languages built into database systems might refer to records, but DOS knows only about bytes in a file. When you create, change, or delete a record, the database application issues a software interrupt instructing DOS to lock a specific range of bytes in a file.

The locked range can extend beyond the end of the file to protect appended data. DOS doesn't clear locked byte ranges automatically, and when bytes are locked no other program can access them. Smart programmers set automatic routines to clear locks before a program terminates.



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where files are shared like a library book: one user at a time.

When an application program opens a data file, the application program can set certain conditions on the simultaneous use of the data file by other application programs. The options enabled under the DOS SHARE command allow programmers to open a file for exclusive use, denying any other application the ability to read or write the file simultaneously, or in other modes that allow reading and/or writing by other applications under certain conditions. Application programs can open data files under a condition called DENY NONE, which opens the file to all applications for all functions at all times.

Many application programs designed before DOS 3.0 open data files by using what is now termed the Compatibility mode. This mode, initially designed for DOS 2.0 backward compatibility, offers no protection against simultaneous users overwriting one another's data in shared files. That's why the safest way to install an application on a network is to give each user a private subdirectory for data files..

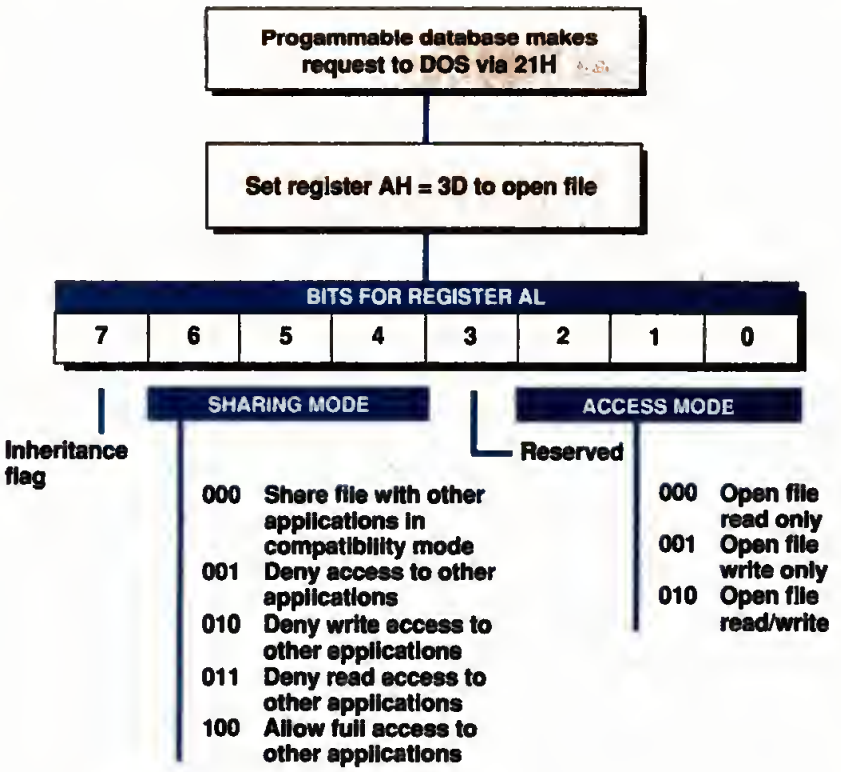
More-modern applications (many designed or updated after the arrival of DOS 3.0 in mid-1984) use one of the DOS 3.0 SHARE modes to open a file. DOS SHARE allows an application program to lock a range of bytes in a file for exclusive use. When a program issues a DOS 21H interrupt and a 5C hex function call (don't confuse this with the 5C hex interrupt that calls NetBIOS), it can then tell DOS how many bytes in a file to lock for exclusive use. Once locked, no other program can write or read them; DOS sends an error message to any application that tries to access a locked data segment.

If the application is not designed to create shared data files, the programmer should design the application to open data files in a mode that denies all access to a second person's attempt to get into a file. In other words, the files created by the application are available to stations on a network on a first-come, first-served but one-at-a-time basis—like a library book.

Unfortunately, there's no safe way to know if the person who wrote the application followed good programming practices—unless you monitor the program's performance on a LAN.

How an Application Opens a File in a Multiuser System

A DBMS programmer can configure software to open a data file in several ways. Different values placed in the AL register can tell DOS to open the file with certain restrictions on its use by the program and with other restrictions on its shared use by another application. Some networked database programs use these DOS features extensively, while others ignore them and use private data-sharing protocols.



THE RIGHT STUFF A LAN really shows its stuff when it comes to giving several people access to the same data file, not one at a time but simultaneously. A database management system is the most common example of multiple simultaneous file access on a LAN.

Database files contain records, and stations must often open more than one file at a time to read records in each file. Other stations might simultaneously have one of the same files open to write records. If one station tries to read a record while another is writing it, a problem will occur.

Database management system packages that have their own programming languages, like *dBASE III Plus*, let programmers use the DOS data-locking function through an internal command called RLOCK. Typically, database programmers use RLOCK to tell the application program to lock one or more specific records before they are rewritten. The DBMS then converts this command into a DOS command to lock a range of bytes.

RECORD LOCKING If you're a database programmer writing applications for a multiuser system, either you or the data-

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base program must tell DOS which bytes to lock to prevent one application from reading a record while another application is writing it. If you have to remember to issue an RLOCK command (as in *dBASE III Plus*), the program is said to have *explicit* record locking. If the DBMS is smart enough to tell DOS automatically to lock a range of bytes while the program writes a record (as in *DataEase LAN*), then the program has *implicit* record locking.

In a multiuser system, you also have to do something about an application that tries to access a range of bytes that are exclusively locked by another program. Some database management programs will return a "Record locked" message to the application program when they run into locked bytes; the application programmer must anticipate getting this message and find a way to handle it.

The options vary for handling a record-locked condition. As a programmer, you can build a loop that tells the application to wait a short time and try again, to abort the application, or to send a message to the screen asking the user what to do.

Some database programs automate this process by automatically retrying the access. They also usually limit the amount of time the record may be locked.

DEADLY EMBRACE The most complex situation takes place when several applications have several files open at the same time. Since records in the different files are indexed to one another in some way, occasionally two applications simultaneously lock data that the other needs to finish a task. Computer literature calls this a *deadly embrace*. Many techniques, such as time-outs, can break a deadly embrace, but whenever such a situation occurs, it slows processing.

To avoid this dilemma, some database management programs, like *Paradox*, don't use the DOS file- and byte-locking options. They do the job for DOS in a more elegant way. When it changes or creates part of a data file, a *Paradox* application leaves a message in a special log file. When it is finished with the file, it erases the message.

Other applications check this log file. If one application needs to read a record being written by another application, it will wait. If the waiting time is too long, the person using the second application receives a message describing exactly which user has the record locked. At this point, it's up to the people using the data to resolve the problem.

This log file architecture is a more elegant way to share data than the commands structured into DOS. It's much easier on the person writing applications, but it also puts a greater load on the network and the server. Each application checks the log file before every access to the data file. And applications writing to a data file write and erase an entry in the log file before and after each data file access. That means there are more packets on the network and many more disk access requests for the server to satisfy than under DOS data protection.

Neither method of protecting data is perfect; both architectures have advantages and disadvantages. But now, at least, PC-based networks have mature methods that allow many people to use the same data at the same time—good news for workgroup computing and workgroup productivity.

In the following reviews, we focus on how 20 programmable database management system programs compare when used on a LAN. With the exception of *Clarion*, you'll find more about how these databases work as single-user applications in *PC Magazine*, May 17, 1988.

—Frank J. Derfler, Jr.

Frank J. Derfler, Jr. is workgroup systems editor of PC Magazine.

Advanced Revelation

For years, serious database users have considered *Revelation* to be one of the best database products available for systems development. Its sophisticated programming language, flexible file structures, and compiler furnished all the tools required by an experienced programmer to develop applications. However, with this sophistication came complexity. It was not a product for the average database user.

To gain wider acceptance for their product, Revelation Technologies Inc. introduced *Advanced Revelation*. This product offers many features designed for the novice user, including a new user interface. However, the beginner may find the menu-driven interface to be not as intuitive or simplistic as hoped. Until you become familiar with the menu structure, you will find yourself traversing menus looking for the functions you desire. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 124).

Although the newest release of *Advanced Revelation*, Version 1.1 ($950; bump disk for four users, $450), does not alter the basic user interface, it does offer additional features for the new user. An expanded help facility can automatically display pop-up help text upon entering each new tool or program. Query and reporting functions have been enhanced to include wildcard searches, an easy-to-use interface to the report writer, and the ability to view reports (up to 250 characters wide) on the screen.

Loading the network version of *Advanced Revelation* turned out to be quite a challenge. Converting a single-user version to a four-user network version requires a $450 bump disk. After loading the single-user version onto a Novell network

FACT FILE



***Advanced Revelation*, Version 1.1**
Revelation Technologies Inc.
3633 136th Pl. SE
Bellevue, WA 98006
(206) 643-9898
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In Short: *Advanced Revelation* is a powerful database-management system that stands out from its competition because of its sophisticated programming language and its wealth of application development tools. Version 1.1 offers additional features for the new user, including extra help facilities and query and reporting enhancements. However, its user interface remains confusing for the novice. LAN record locking is handled both implicitly (for database access through the system menus) or explicitly (defined by semaphores imbedded in programs). Not copy protected.

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Networked Databases: Summary of Features

	Advanced Revelation $950 base price; $450 bump disk for 4 users	Clarion Professional Developer $695 for any no. of users	Clipper $695 for any no. of users	DataEase LAN $700 for 1 user; $750 for each additional 3 users	DataEdge $595 for each 6 users
OPERATING SYSTEMS SUPPORTED					
Novell's *NetWare*	●	●	●	●	●
3Com's *3+Share*	●	●	●	●	●
IBM's *PC LAN*	●	●	●	●	●
Banyan's *VINES*	●	○	●	●	●
REQUIRES					
NetBIOS	○	○	○	○	○
DOS version	2.0 or later	3.1 or later	3.1 or later	3.1 or later	3.1 or later
FILE AND RECORD LOCKING					
Implicit	●	○	○	●	●
Explicit	●	●	●	●	○
MULTIPLE SIMULTANEOUS DATA-ACCESS CONTROL					
With DOS 3.1 RLOCK	●	●	●	●	●
Allows applications to leave messages for one another	○	●	○	●	○
Locks records	●	●	●	●	●
Locks fields	○	○	○	○	○
HAS OWN SECURITY LEVELS OF ACCESS					
Read only	●	○	●	●	●
Modify	●	○	●	●	●
Create	●	○	●	●	●
DATA RECOVERY					
Audit trail	○	●	○	○	○
Mirror image	○	○	○	○	○
MULTIUSER LICENSING					
Site license	●	○	○	○	●
Modules for specified numbers of users	●	○	○	●	●
DATABASE SERVER VERSIONS AVAILABLE					
For Novell's *Advanced NetWare*, Version 2.1	●	○	○	○	○
For Univation's *LifeNet*	●	○	○	○	○

PC—Indicates Editor's Choice ●—Yes ○—No

DataFlex $1,250 for any no. of users	dBASE III Plus 1–6 users: $1,690; $995 for each additional 5 users	DB-Fabs $395 for each 12 users	db_Vista III $990 for any no. of users	FilePro 16 Plus Network 1–5 users: $1,495; $100 for each additional user
●	●	●	●	●
●	●	○	●	●
●	●	○	●	●
●	●	○	●	●
○	○	○	●	●
2.0 or later	3.0 or later	2.0 or later	2.1 or later	3.0 or later
○	●	●	○	●
●	●	●	●	○
●	○	○	○	●
○	○	○	●	○
○	●	●	●	●
○	○	○	○	○
○	●	○	○	○
○	●	○	○	○
○	●	○	○	●
○	○	○	●	○
○	○	○	○	○
○	○	○	○	●
○	●	●	○	○
○	○	○	●	○
●	○	○	●	○

(continues)

(*Advanced NetWare*, Version 2.0), I attempted to bump it to a four-user network. It seems that the Novell drivers could not be recognized by *Advanced Revelation;* so although the system did operate, network record locking was not available. A call to the Revelation Technologies technical staff produced a software fix, and now the network version was ready to test.

Advanced Revelation allows both implicit and explicit record locking. Implicit record locking is performed automatically by the system for data files accessed through the user menus. If a record is locked by another user, you will receive a message indicating that the record is unavailable, and the system will let you retry or exit. Additionally, for system developers, *Advanced Revelation* offers explicit semaphore record-locking through Lock and Unlock statements that must be included in application programs. With this method, programmers have control over both how the record locking is performed and the display of messages to the user. It is disappointing that *Advanced Revelation* does not display which user has locked the record.

The documentation that comes with *Advanced Revelation* is voluminous (seven booklets), yet is well laid out and easy to follow. However, in more than 1,700 pages of documentation, only 12 pages are dedicated to local area networks and record locking. Certainly programmers could use more guidance when embarking on a LAN systems development project.

Advanced Revelation, Version 1.1, will preserve this product's reputation as a high-end systems development tool for both single-user and LAN applications. If you're looking for a database that will support your sophisticated needs, *Advanced Revelation* must be considered.

—T. J. White

Clarion Professional Developer

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- ◘ 4Word 2.0 . . . . . 59.
- ◙ Q & A Write 1.01 . . . . . 119.
- ◙ Grandview 1.0 . . . . . 175.
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- ◙ Inbox *(E-mail; up to 100 users)* . . . . . 349.
- ☐ *Breakthrough* Timeline 3.0 . . . . . 349.

T/Maker ... NCP

- ◘ Scrapbook+ . . . . . 79.
- ◘ ClickArt Business Images . . . . . 28.

The XTREE Co. ... NCP

- ◙ XTREE Pro 1.0 . . . . . 69.

TOPS ... NCP

- *Flashcard (AppleTalk network card; 1 year warranty)* . . . . . 169.
- NetPrint 1.08 *(share printers)* . . . . . 119.
- TOPS 2.0 . . . . . 119.

Traveling Software ... NCP

- Battery Watch *(3½" only)* . . . . . 27.
- ◙ LAP-LINK Plus 1.0. . . . . 85.
- ◙ Desklink 2.0 . . . . . 99.

True BASIC, inc. ... NCP

- ☐ True BASIC 2.03 *(now includes Runtime)* . . 57.
- ◘ Algebra *(includes both I & II)* . . . . . 32.

Vericomp ... NCP

- ◙ SoftBytes 2.0. . . . . 35.
- ◙ SoftBytes 386 2.53 . . . . . 49.

WordPerfect Corp. ... NCP

- ◙ WordPerfect Library 2.0. . . . . 69.
- ☐ WordPerfect 5.0. . . . . 255.
- ◙ WordPerfect Office 2.0 . . . . . 269.

Xerox ... NCP

- ◘ Ventura Publisher 2.0 . . . . . 549.

RECREATIONAL

Accolade ... CP *(reqs. graphics brd.)*

- ◘ Hardball *(baseball simulation)* . . . . . 11.
- ◘ Testdrive *(driving simulation)* . . . . . 24.

Electronic Arts ... CP *(reqs. graphics brd.)*

- ☐ Chuck Yeager's Flight Simulator . . . . . 32.

Infocom ... NCP

- ◙ Zork Trilogy . . . . . 33.

Microprose ... CP

- ☐ F-15 Strike Eagle *(requires CGA)* . . . . . 22.
- ☐ Gunship *(requires CGA or EGA)*. . . . . 32.

Microsoft ... NCP

- ☐ Flight Simulator 3.0 *(reqs. graphics brd.)* . . 35.

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- ◙ Tetris *(addicting mind teaser)* . . . . . 24.
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Sublogic ... NCP

- ☐ Jet 2.1 *(requires EGA or CGA)* . . . . . 33.

XOR ... NCP

- ☐ NFL Challenge 2.0 . . . . . 69.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

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- Tape System/2 *(for PS/2 MicroChannel)* . . 299.
- Retriever/40 *(for IBM AT & compatibles)* . . 349.

AST Research ... 2 years

- I/O Mini 2 C/S/P . . . . . $89.
- SixPakPlus 64k C/S/P *(now upgrades to 576k)* . . . . . 129.
- Advantage Premium 512k S/P *(upgrades to 1 Meg or 2 Meg w/Piggyback)* . call
- Advantage 2 512k *(for PS/2 Models 50/60)* . . call
- Advantage 2-386 *(for PS/2 Model 80)*. . . . . call
- RAMpage Plus 286 512k *(for XT/XT286/AT)* . call
- RAMpage! Plus MicroChannel 512k *(for PS/2 Models 50/60)*. . . . . call

Amdek ... 90 days

- LaserDrive-1 *(CD-ROM Drive)* . . . . . 629.

Compucable ... 2 years

- 2-Position switch box . . . . . 29.
- 3-Position switch box . . . . . 39.

Cuesta ... 1 year

- Datasaver 400 Watt *(standby power unit)* 459.

Curtis ... lifetime

ACCESSORIES

- Disk Hofder DB-1 *(holds 50 5¼" disks)* . . . . . 8.
- Printer Stand PS-1 . . . . . 18.
- Universal System Stand SS-3 . . . . . 25.
- DS-1 Switch Box *(controls 2 printers)* . . . . . 33.

CABLES

- Smartmodem-to-PC Cable *(9 feet)* . . . . . 17.
- Printer-to-IBM cable *(9 feet)* . . . . . 17.

SURGE SUPPRESSORS

- Safestrip SP-3 *(6 outlets; 1 year wrty.)* . . . . . 21.
- Diamond SP-1 *(6 outlets)*. . . . . 32.
- Ruby *(6 outlets; EMI/RFI filtered; 6 ft cord)* . . . 59.
- Ruby-Plus *(w/FAX & modem protection)* . . . . 69.

DCA ... 1 year

- Irma 2 *(3270 emulation board)*. . . . . 729.

Epson ... 1 year

We are an authorized Epson Service Center.

- FX-850 *(80 col., 264 cps, 9 pin)* . . . . . call
- FX-1050 *(136 col., 264 cps, 9 pin)* . . . . . call
- LQ-500 *(80 col., 180 cps, 24 pin)* . . . . . call
- LQ-850 printer *(80 col., 264 cps, 24 pin)*. . . . call
- LQ-1050 printer *(136 col., 264 cps, 24 pin)* . . call
- LQ-2550 printer *(136 col., 400 cps, 24 pin)* . . call
- LX-800 printer *(80 col., 180 cps, 9 pin)* . . . . . call
- *Printer-to-IBM cable (6 feet)* . . . . . 15.

Everex ... 1 year

- 1200 Baud Internal Modem . . . . . 79.
- 2400 Baud Internal Modem . . . . . 149.

5th Generation ... 1 year

- Logical Connection 256k . . . . . 449.
- Logical Connection 512k. . . . . 499.

Hayes ... 2 years

- Smartmodem 1200 . . . . . 299.
- Smartmodem 1200B *(with Smartcom II)* . . . 299.
- Smartmodem 1200B *(no software)*. . . . . 265.
- Smartmodem 2400 . . . . . 449.
- Smartmodem 2400B *(with Smartcom II)*. . . 449.

Hercules ... 2 years

- Graphics Card Plus. . . . . 189.
- Network Card Plus *(with TOPS DOS)* . . . . . 349.

Intel ... 5 years

- 2400B Modem 2 *(internal modem for PS/2 Models 50/60/80)* . . . . . 279.

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80287-8 *(for 8 MHz 80286 machines)* . . . . . 239.
80287-10 *(for PS/2 Models 50 & 60)* . . . . . 279.
80387 *(for 16 MHz PS/2 Model 80)* . . . . . 469.
80387-20 *(for 20 MHz PS/2 Model 80)* . . . . . 679.

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Masterpiece *(with $15 rebate thru Dec.)* . . . . . 94.
Masterpiece Plus *(with $15 rebate thru Dec.)* . . 109.

key tronic ... 3 years
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Kraft ... 1 year
Three-button Joystick . . . . . 33.
High Speed Joystick Adapter Card . . . . . 29.

KYE International ... lifetime
Dyna Mouse GM-6 Plus *(w/Dr. Halo III)* . . . . . 59.

Logitech ... lifetime
Series 2 Mouse *(for PS/2 50/60/70/80)* . . . . . 65.
HiREZ Mouse *(bus only)* . . . . . 89.
Mouse w/Paint Show *(bus or serial)* . . . . . 95.
Mouse w/LogiCAD *(bus or serial)* . . . . . 119.

Microsoft ... lifetime
Mouse with Paintbrush *(bus or serial)* . . . . . 109.
Mouse with Easy CAD *(bus or serial)* . . . . . 125.
Mouse with Windows/286 *(bus or serial)* . . . . 145.

Migent ... 1 year
Pocket Modem *(1200 baud, incl. software)* . . . 119.

MSC Technologies ... lifetime
OmniMouse w/Designer Pop-up menus *(serial only; 1 year warranty)* . . . . . 57.
PC Mouse w/PC Paint+ *(bus or serial)* . . . . . 89.
PC Mouse w/Autosketch *(bus or serial)* . . . . 105.
PC Mouse II w/PC Paint+ *(bus or serial)* . . . . 89.
PC Mouse II w/Autosketch *(bus or serial)* . . 105.

NEC ... 2 years
Multisync II *(800 x 560 max. resolution)* . . . . call

NSI Logic ... 3 years
Smart VGA *(supports full VGA specs)* . . . . . 229.

Orchid Technologies ... 2 years
Tiny Turbo 286 . . . . . 289.
Designer VGA . . . . . 349.
Ramquest 2 . . . . . 549.

PC Power & Cooling Systems ... 1 year
REPLACEMENT POWER SUPPLIES
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Turbo Cool 200 *(run 30° - 45° cooler)* . . . . . 169.
Silencer 200 *(69% noise reduction)* . . . . . 149.

Personal Computer Support Group ... 1 year
Breakthrough 286 Accelerator Board *(8 MHz)* 299.
Breakthrough 286 Accelerator Board *(12 MHz)* 449.

Practical Peripherals ... 5 years
Microbuffer Inline *(par. print buffer w/32k)* 135.
P/Link *(parallel line extender w/32k)* . . . . . 109.

1200 Baud Internal Modem *(w/ProComm)* . $69.
1200 Baud External Modem *(mini)* . . . . . 79.
2400 Baud Internal Modem *(w/ProComm)* 159.
2400 Baud External Modem . . . . . 189.

Princeton Graphics ... 1 year
Ultrasync *(supports CGA, EGA, VGA)* . . . . . 549.

Toshiba ... 1 year
P321SL printer *(80 col., 216 cps, w/tractor)* 529.
T1000 Laptop *(80C88, 6.4 lbs., 5 hr. battery)* call
T1200 Laptop *(80C86, 10 MHz, 20 Meg)* . . . call
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T5100 *(80386, 16 MHz, 40 Meg)* . . . . . call
768k Ram Card for T1000 . . . . . 299.

Video 7 ... 2 years
VEGA Deluxe *(supports 640x480)* . . . . . 219.
VEGA VGA *(supports full VGA specs)* . . . . . 287.
FastWrite VGA . . . . . 399.
VRAM VGA . . . . . 529.

DRIVES

IOMEGA ... 1 year
Bernoulli II Single 20 Meg Internal *(5¼")* . . 779.
Bernoulli II Dual 20 Meg External *(5¼")* . . 1659.
20 Meg cartridge *(5¼")* . . . . . 59.
PC2 Card . . . . . 169.
PC2B Card *(bootable card for PC/XT/AT)* . . 229.
PC4 Card *(for PS/2 Model 50/60/80)* . . . . . 299.

Mountain Computer ... 1 year
40 Meg Internal Tape Drive *(XT, AT or PS/2)* 379.
40 Meg External Tape Drive *(XT, AT or PS/2)* 479.
60 Meg External Tape Drive w/Power Supply & Controller *(AT or PS/2)* . . . . . 1199.

Plus Development ... 1 year
Hardcard 20 Meg *(49 ms)* . . . . . 549.
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FREE PCTV® Hard Drive Installation Tape with the purchase of 20, 30 or 40 Meg Seagate drive for the IBM PC (not for AT). Specify Beta or VHS.
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40 Meg Internal Hard Drive for AT *(40 ms)* . 439.
40 Meg Internal Hard Drive for XT *(w/controller and cables, 40 ms)* . . . . . 499.

TEAC ... 1 year
PC, XT 360k Drive *(5¼" half-height)* . . . . . 89.
720k Drive *(3½" half-height, specify XT or AT)* 95.

Toshiba ... 1 year
AT 360k Drive *(5¼" half-height)* . . . . . 89.

DISKS

All disks have a lifetime warranty.

5¼" DS/DD Disks for PC & XT *(360k)*
Fuji MD2D *(10 disks per box)* . . . . . $12.
Sony *(10 disks per box)* . . . . . 12.
Maxell MD2-D *(10 disks per box)* . . . . . 13.
Verbatim Datalife *(10 disks per box)* . . . . . 13.

5¼" DS/High Density Disks for AT *(1.2 Meg)*
Fuji MD2HD *(10 disks per box)* . . . . . 22.
Sony *(10 disks per box)* . . . . . 23.
Maxell MD2-DD *(10 disks per box)* . . . . . 23.
Verbatim Datalife *(10 disks per box)* . . . . . 22.

3½" DS/DD Diskettes *(720k)*
Sony *(10 disks per box)* . . . . . 19.
Fuji *(10 disks per box)* . . . . . 19.
Maxell *(10 disks per box)* . . . . . 20.

3½" DS/High-Density Diskettes *(1.44 Meg)*
Sony *(10 disks per box)* . . . . . 55.
Fuji *(10 disks per box)* . . . . . 55.
Maxell *(10 disks per box)* . . . . . 59.

MISCELLANEOUS

CompuServe
CompuServe Information Service . . . . . 24.
Grolier's OnLine Encyclopedia . . . . . 32.

Cables ... lifetime
Smartmodem-to-AT cable *(9 feet)* . . . . . 15.
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Networked Databases: Summary of Features

	FoxBASE Plus/LAN $595 for any no. of users	KnowledgeMan/2 $1,995 for any no. of users	LAN Progress 1–16 users: $3,000; over 16: contact vendor	O'Hanlon Database Solution 1–7 users: $995; $700 for each additional 7 users	Paradox Network Pack $995 for each 6 users
OPERATING SYSTEMS SUPPORTED					
Novell's *NetWare*	●	●	●	●	●
3Com's *3+Share*	●	●	●	●	●
IBM'S *PC LAN*	●	●	●	●	●
Banyan's *VINES*	●	○	●	●	●
REQUIRES					
NetBIOS	●	○	●	○	○
DOS version	3.1 or later	3.1 or later	3.0 or later	3.1 or later	3.1 or later (3.2 on IBM Token-Ring Network)
FILE AND RECORD LOCKING					
Implicit	●	●	●	○	●
Explicit	●	●	●	●	●
MULTIPLE SIMULTANEOUS DATA-ACCESS CONTROL					
With DOS 3.1 RLOCK	●	●	●	●	○
Allows applications to leave messages for one another	○	○	○	○	●
Locks records	●	●	●	●	○
Locks fields	○	○	○	○	○
HAS OWN SECURITY LEVELS OF ACCESS					
Read only	●	●	●	●	●
Modify	○	●	●	●	●
Create	○	○	●	●	○
DATA RECOVERY					
Audit trail	○	○	●	○	○
Mirror image	○	○	●	○	○
MULTIUSER LICENSING					
Site license	●	●	●	●	○
Modules for specified numbers of users	○	○	○	●	●
DATABASE SERVER VERSIONS AVAILABLE					
For Novell's *Advanced NetWare*, Version 2.1	○	○	●	○	○
For Univation's *LifeNet*	○	○	○	○	○

—Indicates Editor's Choice ●—Yes ○—No

PC/Focus Multiuser 1–4 users: $1,995; 5–8 users: $4,000; 9–16 users: $6,000; 17–24 users: $9,000	Q-Pro 4 $90; $100 license required for more than 1 user	R:base for DOS 1–3 users: $725; 4–6 users: $995; $2,695 for unlimited no. of users	Team-Up 1–10 users: $1,795; $100 for each additional user	Zim 1–4 users: $1,580; 5–8 users: $2,950; 9–16 users: $4,120; over 16: contact vendor
●	●	●	●	●
●	●	●	●	●
●	●	●	●	●
●	●	●	●	●
○	○	●	○	○
3.0 or later	2.1 or later	3.1 or later	3.0 or later	2.0 or later
○	○	●	●	●
○	●	● (file locking only)	●	●
○	●	●	●	○
○	○	○	○	●
○	●	●	●	●
○	○	●	○	●
●	○	●	●	●
●	○	●	●	●
●	○	●	●	●
○	○	○	○	●
○	○	○	○	●
●	●	●	○	●
●	○	○	●	○
●	○	○	○	●
○	○	○	○	○

(ends)

EDITOR'S CHOICE

PC MAGAZINE

FACT FILE

CLARION PROFESSIONAL DEVEL

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(305) 785-4555
(305) 785-9172 (Bulletin Board System: 300, 1,200, 2,400 bps, no parity, 8 data 1 stop)

List Price: $695; Language Extension Modules: *dBASE*, $49.50; Communications, $49.50; Finance $29.50.

Requires: 512K RAM (640K recommended), hard disk, PC or PS/2 compatible, DOS 3.1 or later.

In Short: *Clarion* is smart and easy to use, yet creates complex custom database applications that can be made into standalone .EXE files. A complex programming language plus internal file and record locks make it a flexible and powerful development environment well suited to corporate or commercial applications, and its price makes it a great value. Not copy protected.

CIRCLE 666 ON READER SERVICE CARD

Well, *Clarion Professional Developer* may not help you use a hammer and saw, but it can make you a pretty flashy database programmer in almost no time at all. This $695 product automates the process of creating complex custom applications, doing almost all the work in most cases and leaving you little to do but sit around and bask in the praise your programming garners.

The difficulty in describing *Clarion* is that it can come out sounding too simple-minded to be useful or too complex to handle. In reality it is neither.

It is easy to use. You start the program and are presented with a menu. One option takes you to a DOS shell that allows you to view directories, enter DOS commands, and more. Another takes you to the full-screen editor. A third option will automatically build *Clarion* data files from *dBASE*, .DIF, or comma-delimited ASCII files, or will export *Clarion* data into those formats. Yet another option gives direct row-and-column access to a data file.

The most impressive option, however, is called the Designer. Here you create

complete custom applications with speed and ease. You start by selecting a template for *Clarion* to use (either standalone or network), and then define your data file structures and procedures.

The screens give a visual map of the structures you create. For example, procedures called from a main menu are listed in an outline structure. A similar approach is used to show the relationship of multiple key fields in an index definition.

You define procedures by selecting the type of action (menu, data form, report, and so on) and then "painting" the prompts and fields right on the screen. You have control over colors, line drawing, and field placement. Just by defining a menu with options, you will get a screen that has a moving highlight bar and allows first-letter command selection (like a *1-2-3* menu).

Clarion can also define a scrolling table screen that permits you to see multiple records from a file. Table lookups for verification and retrieving related fields are also simple to define.

All this sounds simple, but now the magic starts. Run the application through a compile option, and *Clarion* produces a pseudo-code that can be run with the *Clarion* runtime module. There is also an interactive debugger available for testing the application at this stage. Once you have everything working the way you want, you then use the Translate option to create a standalone .EXE version of the application that does not require any other modules at all to run.

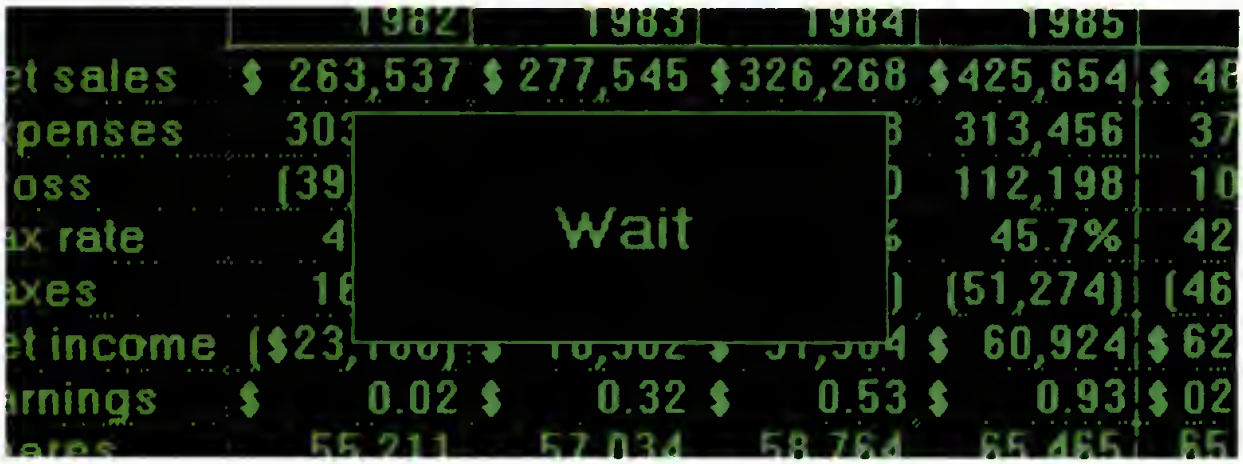
And if you find that the *Clarion*-generated application does not do exactly what you want, you can use the editor to modify the code. You can also have the *Clarion* application call separate procedures that you write from scratch, or even C or assembler routines.

All of these features are the same for both the single-user and the multiuser *Clarion* applications. In fact, you can develop an application for network use and run it on a standalone PC without modification. The only difference between the two templates is that the multiuser version puts in automatic locks for record updates and does not take advantage of some record buffer features that can improve performance of single-user applications.

Clarion uses file- and record-holding flags of its own design, so installation is a snap on a network. There are no complex procedures to follow, though the installation can take some time since the program files come in a packed format on ten separate disks.

The code generated by *Clarion* worked well at protecting records under multiuser access. No automatic message was displayed when a record was locked, but an attempt to modify a changed record resulted in a warning beep and a redisplay of the

STOP WAITING ON TABLES.



modified data. This automatic screen refresh is an important and attractive feature that should be implemented on all LAN databases.

The documentation is large, thorough, fairly well indexed, and easy to read. There are both written and disk-based tutorials, and the 17 sample applications on disk give clear and practical illustrations of how to use the program.

Clarion Professional Developer is overkill for a simple database application but will still do the job quickly and easily with a minimum of fuss. For more complex applications, it will write code in a matter of minutes that would take days in many other database languages. Because *Clairon* lets you distribute applications as .EXE files or with the runtime interpreter and not be liable for additional royalty or licensing fees, it should be most attractive to corporate and commercial developers. Its complex programming language permits extensive customization, so you are not likely to outgrow it, either.

This is a development system that has both good looks and brains. And the best part is that you can always tell people that you "just threw together" your impressive custom applications, and *Clarion* won't complain when you take the credit.

—Alfred Poor

Clipper

Nantucket launched the *dBASE III* compiler market with *Clipper*, and the company remains at the front of the armada with the Summer '87 version ($695). Known for its quick execution speed and enhancements to the *dBASE III* command language, *Clipper* has become an essential tool for the serious *dBASE III* programmer. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 138.)

Clipper's network commands use DOS 3.*x* calls, enabling it to run on any network that adheres to that standard. You can lock both files and records, but it's up to you to apply the locks and determine whether the operation has been successful. Nantucket includes sample programs with the package to demonstrate the process of locking records and files.

The software assumes that only one user can access files opened without networking commands. To share files, you use the SET EXCLUSIVE OFF command at the beginning of your program and then open your files with the USE command. By testing the result of special function NETERR(), you can determine if the file was available (true) or unavailable (false) for sharing. You can force a file to be unavailable for sharing by adding the EXCLUSIVE modifier to the USE command, necessary for functions such as PACK and REINDEX.

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Although files are opened as sharable, you can temporarily lock the file's work area with the FLOCK() function or the current record with the RLOCK() function. Again, you must test the value of the function to determine whether the lock was successful or not. Many commands, such as REPLACE and DELETE, require a lock, and *Clipper* will return a fatal system error if the lock isn't applied before the operation. Once you've updated the file, you can issue an UNLOCK command or attempt another lock to release the file or record. In contrast to *dBASE III*, *Clipper* lets you read files and records while they are locked.

FLOCK() and RLOCK() return the result of only the last locking operation. It's up to you to notify the user of a conflict or to attempt another lock. However, *Clipper* includes a program with routines that perform file and record locks for a user-defined period before reporting the failure. You can easily modify these routines and add them to your programs.

You can use *Clipper* to create standalone executable programs that can be distributed freely without royalties. Since these files are often large, you may want to keep the programs on a local hard disk instead of on the server to speed up the load times. *Clipper* has no automatic recovery mechanism, though, so you'll need to develop your own audit trails and backup transaction files to ensure the integrity of the system.

Clipper's networking commands are simple, and Nantucket explains them well in the manual. The program has enough commands to perform the basic locking functions and control applications effectively.

Clipper is still one of the best tools that you can find for battling through the high seas of *dBASE III* programming on a network.—**Mike Falkner**

PC MAGAZINE FACT FILE



***Clipper*, Summer '87**
Nantucket Corp.
12555 W. Jefferson Blvd., #300
Los Angeles, CA 90066
(213) 390-7923
List Price: $695
Requires: 256K RAM above network requirements, PC or PS/2 compatible, DOS 3.1 or later, and network software using DOS 3.1 function calls. Hard disk recommended.
In Short: The *Clipper, Summer '87* compiler enhances the *dBASE III* command set and its record- and file-locking capabilities on the network. LAN record and file locking are handled explicitly. This compiler is still one of the best tools for *dBASE* programming on a LAN. Not copy protected.
CIRCLE 674 ON READER SERVICE CARD

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DataEase LAN

Looking for a program that is easy to use with a strong menu-driven interface, yet offers a wide range of programmable features that support full-blown custom applications? Want one that will install easily on a network but will give you great latitude in its configuration? Look at *DataEase LAN*.

Like the single-user version, *DataEase LAN* excels in terms of giving the user a powerful menu interface that makes it easy to access files and create reports. It also has a complex query and procedural language that can offer prompts for every step. If you choose not to use the language, you can enter the commands through a full-screen editor. It does have a few drawbacks, such as the limitation to a single data screen for each table, but on the whole it is powerful and flexible.

The LAN version is totally consistent with the single-user version; the current version (1.12) incorporates all the features of the standalone version (2.53). (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 143.) You can even use the new LAN version with *DataEase* add-on products such as *GrafTalk*. The only difference from the single-user version is that the LAN program has a few new procedural commands along with some new configuration options.

Locking procedures are totally automatic, preventing confusion over updated records. If you try to change a record that someone else has modified since you last read it, you will get an error message. One small disappointment is that while the program knows that the original record has been changed, it produces only an error message and does not automatically update your screen.

There are plenty of configuration options in the current version, however. Instead of saddling you with fixed rules for automatic locks, *DataEase LAN* lets you set the system up the way that works best for your application.

You can also write procedures that explicitly lock and unlock records and tables. There is enough flexibility here to perform some complex operations. And a few command combinations and other situations could be hazardous to your data under some circumstances. Fortunately, all these aspects are clearly documented, and the system default settings are conservative yet functional.

Installation is easy. The current version not only supports Novell's *NetWare* (as with past versions) but also adds Banyan's *VINES*, 3Com's *3+Share*, IBM's *PC LAN*, AT&T's *StarLAN Network Program*, and any DOS 3.1 (or later)–compatible network software. With Novell you must use the *NetWare* FLAG utility to

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CIRCLE 517 ON READER SERVICE CARD

mark all files as sharable. The only other trick is that all workstations must boot with a CONFIG.SYS file that contains FILES set to 60.

You have the capability of converting a single-user *DataEase* application to a network version in a single step; no recoding is required. This is a one-way street, however, since you cannot go back to a single-user version without exporting and then importing the application.

The biggest problem with *DataEase LAN* is its price. The $700 base price is for only a single user on the server. You then buy a workstation pack, or bump disk, that adds three more users for $750. As a result, *DataEase LAN* for a five-workstation network will cost $2,200. And you cannot use your single-user-version programs to increase the count (unlike in some other programs), although you can upgrade any 2.5 version for $125. You also cannot use the network version to access single-user databases—for that you need to purchase the separate standalone version of the program. Alternately, you can convert the databases to the multiuser format and access them with a multiuser version of the program.

Power, ease of use, and flexibility make *DataEase LAN* an attractive alternative, but the price per user may give you a moment's pause. If it fits your budget, and you need a multiuser DBMS program to meet the needs of both novices and power users for ad hoc access to shared data, then *DataEase LAN* should be the winner.—**Alfred Poor**

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

DATAEASE

***DataEase LAN*, Version 1.12**
DataEase International Inc.
7 Cambridge Dr
Trumbull, CT 06611
(800) 243-5123
(203) 374-8000

List Price: $700; 3-user bump disk, $750; single-user to multiuser upgrade, $125.
Requires: 640K RAM; DOS 3.1. Runs on Novell's *NetWare* (2.0a or later), Banyan's *VINES* (2.1 or later), 3Com's *3+Share* (1.12 or later), IBM's *PC LAN* (1.1 or later), or AT&T's *StarLAN Network Program* (2.0 or later); both 5¼- and 3½-inch disks included.
In Short: A powerful and flexible multiuser system, *DataEase LAN* is easy to install and maintain. It allows unusual control over automatic locking; in addition, new procedural commands support explicit locking functions in custom applications. Not copy protected.

CIRCLE 670 ON READER SERVICE CARD



CIRCLE 212 ON READER SERVICE CARD



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CIRCLE 333 ON READER SERVICE CARD

DataEdge

Networking with *DataEdge* from PC Manager ($595 for each six stations) is simple and automatic, even effortless—with one caveat. This relational database program offers the ease of menu-driven features combined with a powerful fourth-generation programming language called PAL (Programmer Application Language). It's PAL that can be less than effortless. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 148.)

Using *DataEdge*'s menus, you can easily create your databases and reports by defining elements and adding them to the data dictionary. You can then select routines that use the dictionary to generate screens and reports simply and quickly. For more sophisticated applications you use the powerful, but somewhat difficult, PAL to develop programs to create menus, to test data further, and to exercise more control over the creation of your databases and reports.

One *DataEdge* package works for up to six stations on a network, and it requires no special installation procedures. When you open a database, the program lets multiple users read and write information. If one user is entering information, *DataEdge* locks the entire record and reports both the lock condition and the person accessing the record when a second user goes for the same record. After the update is complete, *DataEdge* releases the record, changes the second user's screen to show the new information, and allows the second user to continue.

When *DataEdge* sees a lock condition, it displays a warning message at the top of the screen, allowing you to wait for the lock to clear. If a record is locked and you don't want to wait, you can press F2 to proceed to the next record, or Esc to try another function. If a file is locked, you can only wait or Escape. When the lock does clear, *DataEdge* will continue with your request automatically.

By using the PAL programming language to issue additional locking commands throughout your application, you can exert more control over shared databases. The ASSIGN command lets you deny users read, write, or all privileges for a file as soon as you open it. In addition, the LOCK_GROUP command locks groups of files, such as vendor and transaction files. It also returns a true or a false condition, which you can test to see if the lock was successful. To save the users from constant lock warnings, you use the SET DATABASE command to enable or disable record locking and to define the number of times the program will retry to establish a lock.

Unlike the automatic mode in *DataEdge*, the PAL command for retrieving records, READ, locks a record once it has accessed it. To release the record immediately for other users, you can add the LOCK(OFF) modifier to READ. In addition, the RETRY modifier will force a failed READ to retry a certain number of times before giving up. After each READ, you must check the STATUS(LOCK) variable to see if PAL read the record properly. If the STATUS(LOCK) variable returns the value ACCESS_DENIED, then the lock has failed and you must notify the user of the problem.

Using *DataEdge* on a network is effortless if you stay away from PAL. To exert more control than *DataEdge*'s automatic record locking affords, you'll need to master the powerful, but difficult, programming language. Then you'll have a real edge over your data.—**Mike Falkner**

PC MAGAZINE FACT FILE



***DataEdge*,**
Version 1.7B
PC Manager Inc.
8229 Boone Blvd.,
#202
Vienna, VA 22180
(800) 654-5845
(703) 356-4600

List Price: $595 for each six stations.
Requires: 384K RAM above network requirements; PC or PS/2 compatible; DOS 3.1 or later. Hard disk recommended.
In Short: This relational database program offers the ease of menu-driven features combined with a powerful but difficult fourth-generation programming language called PAL. If you're not a programmer, stick with the automatic features and enlist someone else to use PAL. Not copy protected.

CIRCLE 673 ON READER SERVICE CARD

DataFlex

DataFlex, Version 2.3, from Data Access Corp. ($1,250 for any number of network users) is a versatile multi-user DBMS that runs on a wide variety of operating systems, networks, and hardware configurations. Available in versions for minicomputers as well as PCs, *DataFlex* is a mature product that can satisfy the most serious database needs. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 152.)

DataFlex for MS-DOS comes in both single-user and multiuser versions, and licenses are obtainable for Full Development or Runtime Only. Also, *DataFlex* is listed on the Government Services Administration (GSA) schedule, and free copies are available for qualified educators.

Since it was rewritten from Pascal to C, *DataFlex* no longer uses overlay files—an advantage when running on a network, where frequent loading of overlay files adds to network traffic and slows performance. However, since all parts of the program are in memory, *DataFlex* takes slightly longer to load; more important, it takes more memory.

Specifically, the Runtime portion needs at least 384K of RAM after DOS, the networking software, and any drivers or memory-resident programs have been loaded. Another factor increasing the memory requirement is that each workstation running *DataFlex* should be booted with a CONFIG.SYS file containing a FILES=90 statement. You can expect reasonable performance with this system using 512K to 640K of memory.

The multiuser capabilities found in *DataFlex* 2.3 have not changed much from those of previous versions. At the heart of the multiuser provisions is a file-locking scheme that locks all open files. No automatic locking system exists to prevent simultaneous users from changing the same data at the same time. Record locking, while available in DOS 3.0 and later, is not offered in the *DataFlex* programming language. To prevent multiuser updating conflicts, you need to use a small segment of programming to implement the file locks.

File locking serves as a relatively coarse means of preventing conflicts in updates. Although LOCK prevents other



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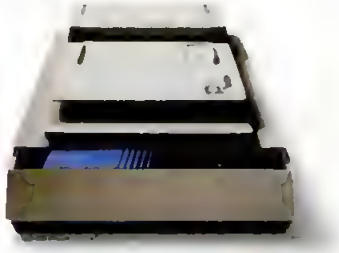
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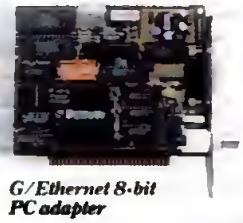


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CIRCLE 247 ON READER SERVICE CARD

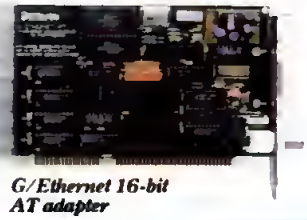
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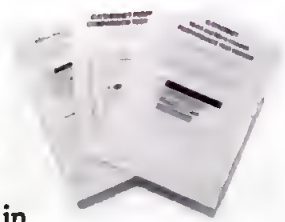


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CIRCLE 146 ON READER SERVICE CARD

people from putting changes to any file currently open in shared mode, it does not affect another user's ability to read or retrieve a record. *DataFlex* reduces the impact of not having record or field locking by using the file locks as briefly as possible. Since waiting for keyboard entry defies the definition of a brief period, you cannot use commands such as ENTRY, ACCEPT, INKEY, and INPUT between a LOCK and an UNLOCK command.

In actual programming, the REREAD command is used instead of the LOCK command. When *DataFlex* encounters a REREAD command in a program, it automatically locks all open files. It then rereads all active records to ensure that you have the most current data. You can modify this data and write it to the database with a SAVE or SAVERECORD command. The UNLOCK command should follow, with as few intervening commands as possible. The UNLOCK command once again allows other people to make changes to the database.

For multiuser data entry, you can use the ENTER macro to specify several database files for updating. *DataFlex* will process ENTRY commands as a related group subsequent to the ENTER macro and before the matching ENTEREND. Since it is inherently a multiuser command, the ENTER macro automatically includes LOCKs and UNLOCKs around the SAVEs as needed.

The secret to optimal performance in a multiuser application is to reduce the number of files opened in a shared fashion. You can CLOSE files that you no longer need as soon as you're finished using them. With the FILE_MODE command, you can change the way a file is treated.

PC MAGAZINE FACT FILE



***DataFlex*, Version 2.3**
Data Access Corp.
14000 SW 119th Ave.
Miami, FL 33186
(800) 451-FLEX
(800) 331-3960 (in FL)
(305) 238-0012
List Price: $1,250 for any number of network users; multiuser runtime version, $300; *LifeNet* database server version, $1,650.
Requires: 384K RAM, DOS 2.0 or later.
In Short: This database is especially strong in data validation, but using it on a LAN requires some programming and careful file management to overcome the lack of record or field locking. A special version that runs on Univation's *LifeNet* results in a high-performance, multiuser, database-server engine. Not copy protected.

CIRCLE 609 ON READER SERVICE CARD



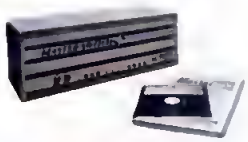
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CIRCLE 290 ON READER SERVICE CARD

Files that are accessed as READ_ONLY or SINGLE_USER do not incur the overhead that is associated with shared multiuser files.

The most exciting feature of *DataFlex* is available only in the special version that runs on Univation's *LifeNet*. The *LifeNet* system uses a unique type of index file throughout its server and networking software. Because index files are an integral part of the operating system, little overhead is required in checking their contents. The system uses index files for everything from the directory structure of the server's hard disk to the data files in *DataFlex* databases. Using a combination of *LifeNet* and *DataFlex*, you can create databases and applications that run on a central "database server" machine. The resulting reduction in network traffic greatly lessens the number of multiuser problems and dramatically increases performance when handling large databases.

Although other vendors may soon support the *LifeNet* network, *DataFlex* is already there. This creative system marks a whole new genre of high-performance, server-based products for MS-DOS. Who says you need to wait for OS/2 Extended Edition?—**Greg Campbell**

dBASE III Plus

Ashton-Tate's flagship product, *dBASE III Plus* ($695, plus $995 for five-user Lan Pack), is undoubtedly the most widely used MS-DOS programmable database manager. Although it's marked for replacement by *dBASE IV* and reveals its age and lack of true relational features when compared with more recently released competitors, *dBASE III Plus* is still the standard by which PC database management programs are measured. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 152.)

dBASE III Plus offers its resources to novices, experienced users, and programmers alike by giving them different ways to address the product. The novice can use the Assistant, *dBASE*'s drop-down menu-driven front end, which builds command strings in a status line as you select commands from appropriate menus. The database user who has mastered *dBASE*'s syntax can work from the dot prompt, an empty screen surrounding a single period, which awaits their next command. Programmers can take full advantage of the rich *dBASE* language (a mix of powerful verbs for database manipulation) and control structures that enable top-down programming.

FACT FILE



dBASE III Plus
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(213) 329-8000
List Price: $695; 5-user Lan Pack, $995.
Requires: 384K RAM, hard disk, DOS 3.0 or later.
In Short: *dBASE III Plus* is the standard against which all other PC database programs are compared. It has been several years since its release, and we await its successor, *dBASE IV*, but *dBASE III* still has much in its favor. The LAN implementation allows password security for data but is restrictive in the way multiple users can retrieve and alter data. Thus the programmer is still required to do most of the work in application development. Program not copy protected; Lan Pack copy protected.
CIRCLE 672 ON READER SERVICE CARD

Each group of users may share in running *dBASE III Plus* on a network. Yet, while the LAN implementation is protective of data, its file access methods are overly restrictive. And it requires far too much programming to create a true multiuser application.

The excellent *dBASE III Plus* manuals feature over 100 pages describing how to install *dBASE* on a network, administer the data files, use password protection, and follow programming guidelines. A DBA file replaces the core *dBASE* program when it's installed onto a network server. This file, included with the single-user program, requires locking a user or company name into the program before installation.

Also included in the package is PROTECT, a password and data file-encryption facility. Once it has been initiated, PROTECT governs access to all database files. Setting passwords for groups of users in PROTECT alone may instill a sense of security, but it would be false protection, since anyone invoking *dBASE* from another directory can still open any file.

You must enable passwords plus file restrictions before PROTECT will encrypt the affected database files and their indexes. You must also still remember to erase the original database files and rename the coded file to take its place; failing to do so will mean there's no security. *dBASE* lets you assign to files four levels of password protection; individual fields have their own user restrictions based on password levels 1 through 8.

To run *dBASE III Plus* on a LAN for use by multiple users, you must first purchase one Lan Pack ($995), which includes five copy-protected disks, for every five users. You must then either install the multiuser ACCESS program on a local (workstation) hard disk or start ACCESS from a local floppy disk; both methods preclude the use of diskless workstations as *dBASE* LAN terminals.

dBASE III Plus offers automatic file locking and key sequence record locking for the interactive user. These locks cause users to experience the constraints of *dBASE*. The BROWSE command offers a convenient method of viewing an entire database in tabular form—scrolling left and right to uncover fields, and up and down through the records. Using BROWSE requires the entire database to be locked, even though it allows you to change only one record at a time.

You can invoke the EDIT and CHANGE commands to alter record content interactively, and you must explicitly lock any record before making any changes. Once a record has been locked, however, no other users may move to or past the locked record, nor may they run any reports using the affected database. The APPEND command requires that an entire database file be locked before a single record may be added—yet another example of the restraints placed on those trying to share *dBASE* files.

To make *dBASE III Plus* a successful multiuser program, the programmer must try to minimize the amount of time records and files are locked. The program affords little help in that regard, since it lacks such features as methods for avoiding file dead-

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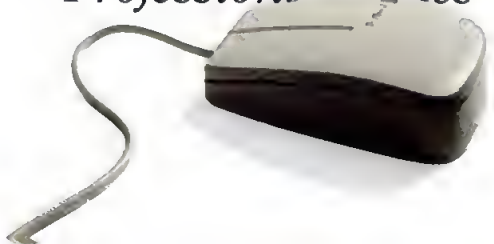
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■ NETWORKED DATABASES

lock, a way to find out who is keeping a record locked, automatic transaction processing for error or crash recovery, and facilities for locking sets of records in related files. *dBASE* will return an error code if a lock is unsuccessful, but the programmer is responsible for building error-correction procedures into an application. Although file- and record-locking commands are part of the *dBASE* language, it's up to the individual programmer to use them intelligently.

dBASE III Plus does offer a degree of file security not available in its syntax-compatible competitors, but at the expense of speed and only after a major investment in additional LAN disks has been made. Other file-compatible interpreters and compilers do not place such a high penalty on their multiuser versions, nor are they so restrictive in their use of both interpretive and programmable commands.

Applications developers looking for a multiuser tool would do well to examine alternatives to *dBASE III Plus*. One multiuser tool that will most certainly deserve attention is the eagerly awaited, soon-to-be-released (at press time) database management program from Ashton-Tate—namely, *dBASE IV*.

—Michael Friedlander

DB-Fabs

DB-Fabs, Version 2.4 Net-N ($395 for each 12 users), from Computer Control Systems is one of those programs that have acceptable combinations of features but don't always make it as multiuser products. You lose about a third of the product's functionality by going to a network. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 158.)

DB-Fabs has much to offer as a single-user program. It runs three ways: as a standalone program; as a compiled runtime version; and as a database engine that can be called from various high-level languages. It has some interesting features, like the ability to install your own favorite editor for creating program code. On the other hand, its help system is limited, the command-driven standalone version is stodgy, and its inability to address subdirectories is a definite drawback.

PC MAGAZINE FACT FILE



DB-Fabs,
Version 2.4 Net-N
Computer Control Systems Inc.
Route 3, P.O. Box 168
Lake City, FL 32055
(904) 752-0912
FAX (904) 752-6873

List Price: $395 for 12 users, $395 for each additional 12 users.
Requires: 256K RAM, Novell's *NetWare* 4.63 and later.
In Short: With limited features and a flawed command-line mode system for sharing files, *DB-Fabs* is best suited for individuals who need a low-cost custom application development system that runs on Novell's *NetWare*. Copy protected.

CIRCLE 671 ON READER SERVICE CARD

The multiuser system runs only on Novell's *NetWare* (although a NetBIOS version of the program is in the works). One handicap is that the documentation for the multiuser version hardly exists. Only three pages address the topic, and the programming language reference doesn't even mention record lock and unlock, the two most important commands.

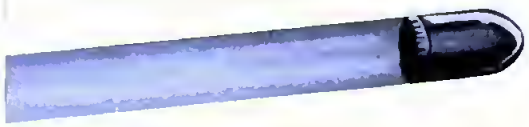
Other glaring omissions in the documentation make using the program problematic. Although you must use the *NetWare* FLAG utility to mark all the *DB-Fabs* files as shareable before you can use them, the manual fails to mention this.

A more serious problem appears when running the standalone version. Record and file locks occur automatically, but we cannot recommend this mode for multiuser operation. There is no provision to write updated records immediately after they are changed; instead they are buffered in the workstation's memory. To update the file, you must execute one of a limited number of other commands (such as add a record, or rebuild an index). This requirement is impractical, and the risk that your changes will be overwritten by another user's update is too great.

In the programmed runtime version, you can solve this limitation by using a command that explicitly forces the changes to be written to disk. But you must

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write all the locks and unlocks by hand as well. The program has only record-lock commands, none are provided for locking files.

Despite its low cost, *DB-Fabs* just does not have enough features to make it attractive for developing broad applications for multiuser systems. It lacks security, and it has no access to paths or other drives (except for index workspace) and it also has no data recovery facilities, which keeps its value down. *DB-Fabs* is appropriate only for users who intend to write their own custom applications on a *NetWare* system and who can work around *DB-Fabs*'s limitations.—**Alfred Poor**

db_Vista III

Raima Corp.'s *db_Vista III* (multiuser version, $990) gives C application developers the ability to produce complete, standalone database applications with an optional SQL-based query interface. It is based on the network database model combined with B-tree indexing. By offering C source code ($1,980 gets you the multiuser version with source code), its own libraries, and compatibility with most popular C compilers, *db_Vista* caters to the seasoned C programmer. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 163.)

To protect the integrity of multiuser databases, *db_Vista III* implements a standalone lock manager that acts as a centralized systemwide file lock and recovery coordinator. The lock manager relies on NetBIOS being present: you must execute it only once before opening any databases. A memory-resident program that uses less than 64K of RAM and can reside on any node of the network, the lock manager is responsible for synchronizing all lock requests from individual users.

Even though *db_Vista III*'s principal locking mechanism is file lock (read, write, and exclusive locks are possible), the program offers some good performance-enhancement features. Its file lock upgrade and downgrade mechanism, for example, allows a database to remain in virtual page buffers, thereby reducing the amount of disk I/O. Declaring menus and help screens static—that is, nonchanging—excludes them from the usual lock requirements and enhances the performance of the system even more.

db_Vista III supports record locking through the setting of a record lock bit. But it's entirely up to the application code to check record locks before issuing updates.

The program addresses the issue of deadlock by using a time-out function that specifies how long an application lock request can stay on the queue before being denied. You can change the default time-out of 10 seconds programmatically. When running *db_Vista III* in a multiuser environment, it is important to know that the application program is always responsible for checking the return code from the lock manager, aborting the transaction, and restarting it to prevent deadlock.

If a transaction terminates abnormally, *db_Vista III*'s lock manager ensures automatic recovery by using the systemwide Transaction Activity File (TAF) to restore the database without disturbing other users on the network. Within an application, each user is identified by a unique DBUSERID environment variable or a programmatically determined user ID. *db_Vista III* generates individual dbuserid .log files in the central directory, where the database and the application as well as the TAF file must reside. The program offers no other security features.

Good program design and clean, modular programming techniques are essential ingredients for a successful *db_Vista III* multiuser application. *db_Vista III*'s user manual helps out by giving sound guidelines and examples of how to implement the different locking schemes in a C program.

db_Vista III is an economical as well as flexible multiuser database management tool for the adept and experienced C programmer who needs to integrate multiuser requirements into an existing C toolbox.—**Isabella McPeak**

FACT FILE



db_Vista III
Raima Corp.
3055 112th Ave. NE,
#100
Bellevue, WA 98004
(800) db-RAIMA
(206) 828-4636
List Price: *db_Vista III:* $1,980 for multiuser version with C source code; object code only, $990; ($990 for *db_Query:* $990 with source code, $1,980.
Requires: 256K RAM or more (depends on application); DOS 2.1 or later. Compatible with Microsoft C 4.0, Lattice C 3.20, Aztek C compilers.
In Short: Designed for the experienced C programmer rather than the end user, this flexible, economical multiuser database is well suited for integrating multiuser requirements into an existing C toolbox. Not copy protected.

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filePro 16 Plus Network

filePro 16 Plus Network, from The Small Computer Company ($1,495 for up to five users; $100 for each additional user), offers casual users carefully validated data input without programming, and applications developers will appreciate its easily mastered procedural language. Combined with transportability over several operating systems, *filePro 16 Plus* looks like a useful data manager for small and large applications. But its poor documentation forces you to spend an inordinate amount of time learning the program and discovering its features. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 178.)

Working with *filePro 16 Plus* on a network is little different from using it on a standalone computer. The manuals make few references to networks or multiuser applications, and the procedural language includes no commands for record or file locking. Record locking is automatic, and conversion from single to multiuser is fairly simple.

The one point to which the programmer must be sensitive is the prompt release of records once they have been edited. Record locking is automatic in *filePro*, and records remain locked across the network until released. Another user who wishes to update a locked record receives the message "Record is being updated—access denied." When a record is released, all those waiting to use it will see the first user's changes. Unfortunately, the program doesn't indicate who has locked a record, so using *filePro* interactively on a LAN is

FACT FILE



filePro 16 Plus Network
The Small Computer Co. Inc.
41 Saw Mill River Rd.
Hawthorne, NY 10532
(800) 847-4740
(914) 769-3160
List Price: $1,495 up to five users; each additional user, $100.
Requires: 512K RAM, NetBIOS-compatible LAN, DOS 3.0 or later. Hard disk recommended.
In Short: Inadequate documentation handicaps this otherwise productive database manager for both programmer and nonprogrammer alike. The LAN version features automatic record locking and transparent conversion of single-user programs. Not copy protected.

CIRCLE 667 ON READER SERVICE CARD

chancy, for example, if users break for lunch in the middle of an edit.

Files are locked whenever modifications are made to their structure; conversely, you cannot alter an open file. If you turn off or reboot the computer while *filePro* has files open, these files will contain locks preventing their use by others. If you display a directory of *filePro* files, highlight the locked file, and type UL, *filePro* will unlock the file. Yet this method will not unlock a legitimately locked file.

The network implementation of *filePro 16 Plus* is in keeping with its simple procedural programming methods and its usefulness in interactive mode as a file manager. If *filePro 16 Plus* is your choice of development tool, upgrading to a multiuser environment should pose no problems.—**Michael Friedlander**

FoxBASE Plus/LAN

Unless you've been living on a desert island the past few years, you know that *FoxBASE Plus* is the reigning speed champ of the *dBASE III Plus* workalikes. Besides the single-user *FoxBASE Plus* product ($395), Fox Software offers *FoxBASE Plus/LAN*, Version 2.10, ($595) to compete with Ashton-Tate's *dBASE III Plus LAN Administrator*. This product makes programming a multiuser application much easier than with standard *dBASE III Plus*. It supports Novell's *Advanced NetWare*, IBM's *PC LAN*, and any other NetBIOS-compatible network. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 182.)

FoxBASE Plus/LAN requires DOS 3.1 or later and at least 360K of RAM. For most people this means that you need a system with at least 512K of conventional memory. The "more is better" rule applies because *FoxBASE Plus/LAN* uses dynamic memory management to make good use of available memory, including EMS.

Even though *FoxBASE Plus/LAN* works like *dBASE III Plus*, you'll find a few differences when you compare the two programs. For example, *FoxBASE Plus/LAN* does not limit the number of simultaneous users, so there's no need for "bump" copies. Similarly, the multiuser runtime version does not limit the number of applications you can create and distribute, nor does it limit the maximum number of users. Although *FoxBASE Plus/LAN* is not copy protected, you must use an "activation key" during the installation process to ensure that all copies are traceable once they have been activated.

While *FoxBASE Plus/LAN* can run *dBASE III Plus* programs without modification, you should compile the programs for faster execution and better use of memory. The current version does not support a few *dBASE III Plus* commands (the ubiquitous CATALOG function, for example), but for the most part, you won't miss them.

Generally, you should not install *FoxBASE Plus/LAN* and *dBASE III Plus* on the same system. While *FoxBASE Plus/LAN* can read from *dBASE III Plus* files, the reverse is not necessarily true. If *FoxBASE Plus/LAN* reads a *dBASE III Plus* index file, it will automatically convert it to the *FoxBASE Plus/LAN* format, which tends to be smaller than the *dBASE* format. You wind up with two different index files, which can easily get out of sync.

The enhancements of Version 2.10 are designed to make *FoxBASE Plus/LAN* more robust and to fill in the few remaining gaps between it and *dBASE III Plus*. New in Release 2.10 is FoxCentral, an elegant menu-driven interface designed for even casual users. FoxView, a powerful and easy-to-use screen painter, replaces the *dBASE* CREATE/MODIFY SCREEN command. When used in conjunction with FoxCode, an applications generator, FoxView lets you program pull-down and pop-up menus within your applications.

Going beyond being a mere *dBASE III Plus* workalike, *FoxBASE Plus/LAN* has enhanced many of the standard *dBASE III Plus* commands to make them more useful. For example, you can use the familiar BROWSE command with the attributes NOFOLLOW and NOMODIFY. The NOMODIFY attribute lets the user look at but not change the data; the NOFOLLOW attribute works with indexed files to prevent the record pointer from "jumping" unexpectedly to a different record if you modify the indexed field.

The most significant enhancements for *FoxBASE Plus/LAN* are automatic file and record locking. While not as powerful as the Co-Edit features of *Paradox* 2.0, the features of *FoxBASE Plus/LAN* are light years ahead of those of *dBASE III Plus*. A 24-page section of the manual deals with *FoxBASE Plus/LAN*'s multiuser commands, in addition, several program segments illustrate the proper use of the record- and file-locking functions.

The program automatically locks files when you issue certain forms of the AP-

FACT FILE



FoxBASE Plus/LAN, Version 2.10
Fox Software Inc.
118 W. South Boundary
Perrysburg, OH 43551
(419) 874-0162
List Price: *FoxBASE Plus/LAN*, $595, *LAN Runtime*, $700. (Note: *Runtime* is for an unlimited number of copies; *Runtime* purchase requires purchase of *FoxBASE Plus/LAN*.)
Requires: 360K RAM above network requirements, NetBIOS, DOS 3.1 or later.
In Short: *FoxBASE Plus/LAN* is the speed champion of the code-compatible *dBASE III Plus* workalike programs. Unlike *dBASE III Plus*, it also boasts automatic file and record locking. Not copy protected; no maximum number of users per copy.

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PEND, BROWSE, DELETE, INDEX, JOIN, RECALL, REPLACE, and UPDATE commands. It automatically locks records for certain record-oriented commands, such as DELETE, DELETE NEXT 1, RECALL, and REPLACE RECORD. To protect against data corruption and loss, these locks prevent others from making changes to the database, but they do not prevent others from reading data. With no programming at all, two users may BROWSE the same database, with the first user being allowed to make changes and the second allowed only to look at the data. You can also use automatic locking in conjunction with explicit record locks to reduce the number of lines required in your programs.

Trying to build a multiuser application that relies exclusively on *FoxBASE Plus/LAN*'s automatic locking features would be unreasonable, however. But since most multiuser applications are fairly complex, you'd implement them with the aid of programming anyway. If you were using *dBASE III Plus*, for example, you would have to use explicit RLOCK() and FLOCK() functions to create an effective multiuser application. Similarly, you need to use these explicit locking functions with *FoxBASE Plus/LAN*.

To make certain programming tasks a little easier, *FoxBASE Plus/LAN* includes functions such as SYS, which gives the programmer handy information not available with *dBASE*. Another nice feature is that you can run any *FoxBASE Plus/LAN* program in the single version of *FoxBASE Plus* without modifying it, because the system ignores any multiuser-specific commands—without producing an error.

Combining these multiuser enhancements with those found in single-user *FoxBASE Plus*, Fox Software has created a product that's superior to its *dBASE* role model in many ways. While the automatic record and file locking help protect against corrupted databases, programming is still required for most multiuser applications. The database engine is capable of industrial-strength applications (Fox Software uses it in-house with a 21MB database that 26 people share). If your company relies on *dBASE III Plus* databases and programmers, *FoxBASE Plus/LAN* is just the tool you need.—**Greg Campbell**

KnowledgeMan/2

KnowledgeMan/2, from mdbs Inc. ($1,995 for an unlimited number of users), has a reputation as an industrial-strength database. The newest release, Version 2.5, includes so many features that it could prove impossible to outgrow. (For a review of the single-user version of Version 2.01, see *PC Magazine*, May 17, 1988, page 184.)

For example, there is a sample application in the new disk-based tutorial (written completely in *KMan* code) that shows off some pretty impressive capabilities. Data is read from a database into a spreadsheet where calculations are made. Based on the contents of certain cells, a form letter in a text file may be printed. If it is, records are extracted from the database according to selection criteria and merged into the text. And all this can be executed automatically by *KMan* procedure files.

Like its single-user counterpart, *KMan* LAN is a powerful language that is better suited for developers of custom applications or power users than it is for typical end users. The syntax is based on an SQL-like structure, making it relatively easy to use either from the command line or in procedure files. Its strengths lie in the ability to link multiple tables with relatively simple statements and near-total user control of all environmental settings.

KMan was one of the first handful of database packages to be offered for PC-based LANs, and given mdbs's extensive experience in minicomputer and other multiuser environments, it has a reputation for being one of the more reliable systems. Not only does it run on most of the popular PC-based LANs, but you can also get a version of the program that runs on a DEC VAX.

KMan 2.5 has a number of major and minor changes over prior versions. Some are handy little items, such as a command line editor that allows you to recall and edit the last 15 commands (similar to the *dBASE* HISTORY feature). There is a new KMan> prompt that replaces the original (and cryptic) underscore. Ctrl-Break no longer bombs you out to DOS, but now opens a window with up to four different options. There is even a command that automatically builds a five-table data dic-

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tionary that conforms to SQL definitions.

The program offers both explicit and implicit record and file locking. Some operations may not be performed on a shared file, such as restructuring a data file, and the program will not let a user gain exclusive use of the file if it is in use at other workstations.

Other implicit controls appear at the record level. If one user is updating a record using the BROWSE command (similar to EDIT in many other programs), another user trying to access the same record will be put on hold temporarily. Once the first user finishes making the changes, the second user's screen is updated and freed to make a change.

One problem with this record-level lock, however, is that it does not give a message at first. The screen just freezes until the retry time-out is reached, at which time a prompt appears explaining that the record is in use and offering to retry. This time-out is set to 60 seconds, which is long enough for the frozen screen to convince even the most confident user that the computer has crashed. Fortunately, this is *KMan*, and you can reset the time-out interval to whatever period you like.

More serious is the problem encountered when trying to gain exclusive access to a table in use. The USE LOCAL command does not give you any indication that you have not succeeded in opening the table; *KMan* displays a colon and the table name, and then returns you to the *KMan* prompt. Some other functions, such as trying to redefine the structure of a table in use, will at least return a message that the table was not available.

Aside from these problems, *KMan* handles LAN problems with aplomb. Only one record per workstation is buffered at a time, which limits the maximum loss due to a crash (although you can lose your index files as well). Data, procedure files, and even the *KMan* program and overlays can reside either on the server or local workstation disks, giving the administrator great flexibility in designing data flows to minimize network tie-ups.

KMan LAN is licensed on a per server basis, eliminating the need for bump disks or user counts. It is not copy protected, so there are no key disks to inhibit use on diskless workstations.

At $1,995, it is more expensive than some competitors until you get up to ten or more users, but you must also consider what you get for the money. Besides the *KMan* database management modules, you also get all the other modules that were optional with earlier versions. These include a screen generator, a text editor, mouse support, a communications module, a graphics component that includes 3-D bars and exploded pie charts, a natural language interface, and even a link to C programs.

Power, flexibility, and value for larger installations make *KnowledgeMan/2* an attractive option in the LAN database marketplace.—**Alfred Poor**

PC MAGAZINE FACT FILE



***KnowledgeMan/2*, Version 2.5**
mdbs Inc.
P.O. Box 248
Lafayette, IN 47902
(800) 344-5832
(317) 463-2581
List Price: $1,995 for unlimited number of users.
Requires: 512K RAM, DOS 3.1 or later. Runs on Novell's *NetWare*, 3Com's *3+Share*, IBM's *PC LAN*.
In Short: A powerful, flexible multiuser database environment that is of greatest value to those developing custom applications for installations of ten or more users. Not copy protected.

LAN Progress

Progress Software Corp. created *Progress* ($3,000 for 16 users) for people who design and manage large, multiple databases running on a variety of hardware setups. Its powerful query language, automatic screen formatting, and fourth-generation procedural language make it a natural for applications developers or MIS departments. The manuals that describe the program place second to none in terms of clarity and understanding the developer's needs. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 220).

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AVERY

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■ NETWORKED DATABASES

The LAN implementation of *Progress*, Version 4.2a, makes it obvious that multiuser features were part of the program from the beginning. *Progress*'s Before-Image and Roll Forward files, as well as its standard backup procedures, responsibly handle the recovery data lost through either software or hardware malfunction or through operator error.

The program's Log file stores all transactions posted during a *Progress* session, and *Progress* copies each record to a Before-Image file prior to modification. If a user's machine fails during file updates, *Progress* displays a message informing the user that all incomplete transactions are being backed up the next time the application is started. This backup process is automatic but may be disabled during mass changes such as global field updates.

Roll Forward recovery, which you must specifically enable, uses an After-Image file containing a copy of each record made after modification. For recovery after the failure of the primary fixed disk, this file must be on a disk different from that of the main database. Used in conjunction with *Progress*'s total or incremental backups, Roll Forward recovery can restore a database after total failure of the database disk drive.

All this record writing has a cost in terms of operational speed, and Progress Software offers suggestions on how to minimize its impact in the well-designed manuals that fully describe all details of the backup and recovery procedures.

You must start multiuser *Progress* applications on a database server, a networked computer performing no function other than maintaining the *Progress* databases. You can store data files on this machine's fixed disk or on the network server's disk. In the interest of speed, *Progress* recommends that you place procedure files (programs) on the local workstations.

The database server processes all requests for data made by the workstations, thus speeding all queries by sending only records that fulfill the query criteria across the network. Databases that perform queries at the workstation level could demand that an entire table be transmitted from server to workstation—only to find that there are no matching records. Note that you can run only one application at a time on the database server. This restriction should not normally present a problem, since a single application could encompass every data table of an organization.

Record locking is both explicit and implicit in *Progress*. Unless programmed otherwise, *Progress* will automatically put a SHARE-LOCK (no update allowed) on any record read and an EXCLUSIVE-LOCK (no read allowed) on any record updated. The *Progress* procedural language lets a programmer use these record locks in conjunction with NO-LOCK, which allows reads during exclusive locks. You could lock entire blocks of records over several tables during transaction processing; the program would automatically release them all at the end of the process. *Progress* issues users wishing to update locked records the user ID and terminal ID of the workstation locking the record, along with a message declining their request.

The *LAN Progress* program handles security issues with the data dictionary, through which the network administrator assigns passwords to users, files, and fields. Files may be assigned Read, Write, Create, or Delete attributes, and fields may be given Read or Write status. All of these are available through matching or excep-

PC MAGAZINE FACT FILE



***LAN Progress*, Version 4.2a**
Progress Software Corp.
5 Oak Park
Bedford, MA 01730
(800) FAST-4GL
(617) 275-4500
List Price: $3,000 for up to 16 users in full development package. For more than 16 users, contact vendor.
Requires: 512K RAM, hard disk, DOS 3.0 or later.
In Short: This fourth-generation development tool features a powerful language, automatic error recovery, and transaction processing—all superbly detailed in the manuals. Dedicated database server required for network use; automatic and programmable record locking protect shared network files. Not copy protected.

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tion password rules that are defined within the dictionary.

The $3,000 full development license allows up to 16 users to access the *Progress* data files, and site licensing is available. A runtime package suitable for vertical market distribution is $700, and the addition of the $1,400 Query package allows users to interrogate the database.

LAN Progress is beautifully documented and efficiently designed. We were surprised at how much you can accomplish through the command line. Programmers who appreciate not being isolated from the business at hand by endless menus and file windows will find *Progress* a valuable tool for database applications development.

—Michael Friedlander

O'Hanlon Database Solution

O'Hanlon Database Solution, Version 3.4 ($995 for up to seven users; $700 for each additional group of seven users), from O'Hanlon Computer Systems, comes to the DOS world from MP/M and other popular multiuser operating systems. Besides a fourth-generation language, the menu-driven software includes utilities for screen creation, data dictionary definitions, program editing and compiling, and file rebuilding. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 196.)

You must create a data dictionary to begin your application. After executing a simple definition process, you enter the screen painting routine to design a layout and attach data elements to it. From here the program can automatically generate and compile program code to create a simple entry screen and accept data. You can create reports much as you do screens, but you must create your own program code to print the report.

In addition to the various MP/M and other non-DOS multiuser systems, *O'Hanlon* runs on many DOS network operating systems including *NetWare*, 3COM's *3+Share*, IBM's *PC LAN*, and others that use standard DOS 3.1 network calls. To initiate the networking function, you run UNISETUP, an installation program, and change the default settings from single user to your network environment. Otherwise *O'Hanlon* locks all files as if they were for single users only.

O'Hanlon's file- and record-locking techniques are very simple. To lock the entire file, you issue a LOCK FILE ALL RECORDS command after you open a file. *O'Hanlon* will exclude all other users from the file until you close it or execute an UNLOCK FILE command. The program also keeps track of the number of users that have the file open. However, if the system fails without an orderly file closure, the count remains, and you must use a utility program to let users open the file again.

Each time you open an *O'Hanlon* file, any number of users can read and write to it without error. To ensure the integrity of the data, however, you need to use the LOCK FILE BY RECORD command in your program after you open each file. *O'Hanlon* automatically locks every record that you access until you read another record or you issue a CLEAR RECORD NUMBER command. But once you've used CLEAR, you must reread the record and reestablish the lock before you write

PC MAGAZINE FACT FILE



***O'Hanlon Database Solution*, Version 3.4**
O'Hanlon Computer Systems Inc.
11058 Main St., #250
Bellevue, WA 98004
(206) 454-5350
List Price: $995 for up to seven users; $700 for each additional seven users.
Requires: 128K RAM above network requirements, hard disk, PC or PS/2 compatible, DOS 3.1 or later.
In Short: This nonrelational database toolkit and language offers basic networking capabilities; using it to create systems generally requires some programming ability. Not copy protected.

CIRCLE 662 ON READER SERVICE CARD

PC MAGAZINE EDITOR'S CHOICE

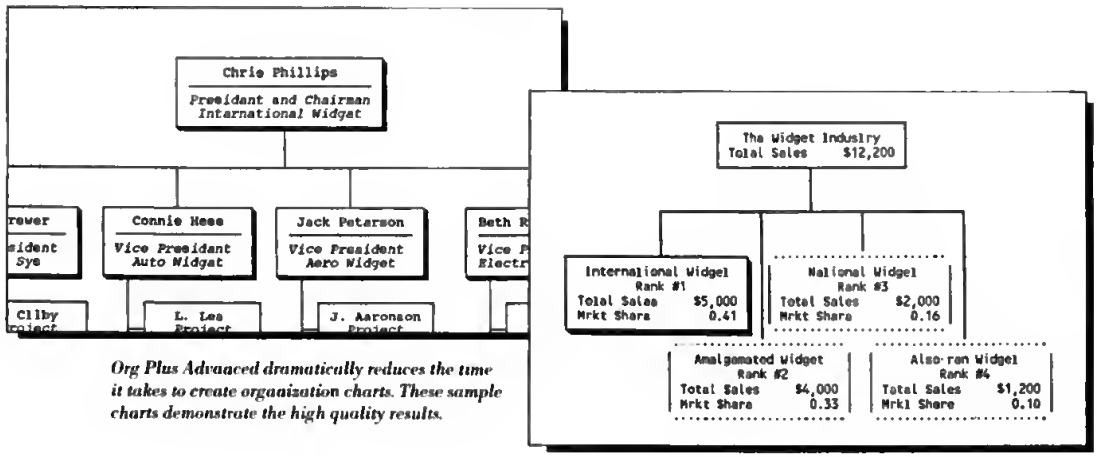
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* Awarded by *PC Magazine*. Org Plus Advanced and Org Plus work on an IBM PC XT AT, the PS 2 Family, or 100% compatibles. DOS version 2.0 or higher and a printer or HP Plotter are required. Org Plus Advanced requires 384Kb RAM, (512 Kb recommended). 5¼" and 3½" diskettes are included, include up to 600 positions in a chart. Org Plus Version 3.1 requires 320Kb RAM, 3½" diskette available on request, include up to 350 positions in a chart. IBM is a registered trademark of International Business Machines Corp. © Copyright 1988 Banner Blue Software Incorporated. All rights reserved. Main offices at Fountain Square.

CIRCLE 496 ON READER SERVICE CARD

out changes, or the program will add it as a new record at the end of the file.

Error trapping for locking conflicts are foolproof. *O'Hanlon* includes a TRAP LOCKS command that captures locking problems and branches your program to a custom routine that you create for the situation. In the absence of the TRAP command, *O'Hanlon* displays an error at the bottom of the screen, notifying you of the problem. You can then hit either the Enter key to try again or the Esc key to resume the program at the beginning of the screen entry routine.

Its multiuser roots make *O'Hanlon Database Solution* wellsuited for use on a network. Although you'll need to use custom routines to make the locking transparent, adding files and record locking to *O'Hanlon* is relatively painless.—**Mike Falkner**

Paradox Network Pack

Paradox Network Pack ($995 for a six-count LAN Pack) has made a name for itself as the database with the unusual interface. With the arrival of Version 2.0, it presents new features designed specifically for local area networks and multiuser applications. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 209.)

There's no difference between the single-user and multiuser versions in terms of the program you receive: all the same commands are present. Both use the same distinctive query system that produces temporary answer tables that you then process further to create formatted reports. Both have a comfortable program language that spans simple recorded keystroke scripts and complex custom applications.

The main difference with the LAN version is that you get a "six-count" serial number on the program disk. *Paradox* limits the number of concurrent users on the system to the total number of authorized serial numbers. Since the program is not copy protected, this design is not particularly oppressive. So although you are limited to a certain number of "user slots," these are not assigned to specific workstations (as would be the case if you were required to use key disks). You can use single-user versions to bump the user count, or you can install the single program on a workstation's local disk, in effect assigning that slot to that station permanently.

One of the nicest advantages of running *Paradox* on a network is that almost all its features are available without programming. In fact, most of the record- and file-locking features are so automatic that they do not require any intervention at all.

For example, if more than one station is viewing a table (has it open for use), a station cannot then simply Edit a record. You must choose the Co-edit command, which locks the record. Any other station trying to change the record gets a message that your station has the record locked. Once your station finishes the edit, the other station can make its changes.

Perhaps the flashiest detail is that the changes made on other stations automatically update your station's screen. And you can adjust the frequency of these updates. Other programs may offer similar features, but automatic updating is most impressive in *Paradox*.

Paradox is one of the easiest programs to install on a LAN that I encountered in this testing. A series of well-designed batch files handle most of the tasks, and the manuals make it clear what network configuration details need adjustment. The documentation includes lucid instructions on proper MAP and PATH assignments, for example.

The *Paradox* armor has a few chinks, though. Some are relatively harmless: if workstations are using different copies of a specific configuration file, one or more workstations may be entirely locked out from certain data tables. More serious is the problem that can arise when two stations refer to the same subdirectory through different logical drives, such as F:\data on one and G: on another. *Paradox* will not be able to recognize them as being the same and will not handle the locking messages properly. The documentation covers these potential problems and offers good examples, however, so careful study and good management should avoid them.

Paradox ranks high among multiuser databases for end users of wide-ranging ability. Aside from the fact that some expert database users may find its design difficult to grasp, *Paradox* is a powerful system that takes good care of users and their data.—**Alfred Poor**

PC/Focus Multiuser

PC/Focus Multiuser, Version 3.0, is Information Builders' LAN version of its mainframe *Focus* database, offering fourth-generation language programs, power, and flexibility for a price of $1,995 (4 users) to $9,000 (24 users). Even though it's based on the hierarchical database management system model, *PC/Focus* can perform relational operations as well. You create all procedures by using the integral XEDIT-like editor, and you form queries with *Focus*'s EQL (English Query Language). (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 212.)

PC/Focus Multiuser 3.0 is a completely new product, distinguished from its mainframe ancestor through the use of color, windowing, graphics, and automated queries. Unfortunately, the user interface is inconsistent, context-sensitive help is absent, and the documentation is geared to mainframe MIS departments rather than PC users. Nevertheless, *PC/Focus* is an important product worth considering for applications development.

Once you've chosen *PC/Focus* for your application, running it single-user or networked matters little in terms of programming or software operation. *PC/Fo-*

PC MAGAZINE ■ FACT FILE



***Paradox Network Pack*, Version 2.0**
Borland International Inc.
1800 Green Hills Rd.
Scotts Valley, CA 95066
(800) 543-7543
(408) 438-8400

List Price: $995 for a six-count LAN Pack
Requires: 640K RAM, DOS 3.1 or later, IBM PC compatible or PS/2, graphics monitor.
In Short: Powerful and easy to install, *Paradox* is best suited for those who are comfortable with spreadsheet database concepts. The LAN version automates sophisticated and intelligent locking strategies. Not copy protected.

CIRCLE 661 ON READER SERVICE CARD

cus Multiuser demands a dedicated database server—an 80286 or 80386 computer used solely for handling data requests within *PC/Focus* (but don't confuse this computer with the network server some LANs require to control network activities). If the database server has a fixed disk of appropriate size, you can store all data files on it, thereby saving the time necessary to transmit data to the database server from the network server's fixed disk. The network server can store program files; otherwise, to enhance speed, the workstations can store program files if storage is available locally. The requirement for a dedicated computer is an expense, but it pays off in speed and data integrity.

You start *PC/Focus Multiuser* on the database server by inserting a copy-protected key disk configured with the number of allowable users. Information Builders handles additional LAN users by supplying new 3½- or 5¼-inch key disks up to a maximum of 32 active workstations. The single-user program is also copy protected, but its protection scheme is not conducive to installation on network disks.

All requests for data pass through SYNC, the database control program running on the dedicated computer. SYNC displays a screen on the database server that shows all active *PC/Focus* users, the files they have opened, and the procedures currently running. The workstations pass all queries to SYNC, and the dedicated machine processes the queries; only matching records pass through the network back to the user. This method is far more efficient than sending entire tables across a LAN for filtering at each workstation.

PC/Focus Multiuser has no record or file locking in the traditional sense. All requests for data are passed to SYNC from the calling workstation, and a copy of each record is kept in SYNC's own buffers. Any number of users are allowed edit privileges on a single record, but only the first to save will have his changes written to disk. When any others try to save, *PC/Focus Multiuser* tells them that their record is no longer current, shows them the updated copy, and allows them to make new changes. All edits and additions are written immediately to disk, thereby reducing the risk of lost data to single records. You can run reports while edits are in progress, and any output will be guaranteed current at the time of printing.

Passwords and security are an integral part of *PC/Focus*. You can assign view and edit privileges to groups of users, and they are active down to the field level.

PC/Focus Multiuser offers the obvious advantage of seamless integration with any mainframe running *Focus*, but it's more than a PC-to-mainframe-to-PC program. Its exemplary report writer, 3-D graphics, automated window building and application development, and fourth-generation language all qualify it for consideration where serious data management is the goal. Also, *PC/Focus Multiuser*'s "no lockout" file handling and central query processing make it valuable when data integrity and efficiency are important.

—Michael Friedlander

PC MAGAZINE FACT FILE



***PC/Focus Multiuser*, Version 3.0**
Information Builders Inc.
1250 Broadway
New York, NY 10001
(212) 736-4433
List Price: $1,995, 1–4 users; 5–8 users, $4,000; 9–16 users, $6,000; 17–24 users, $9,000.
Requires: 640K RAM, hard disk, DOS 3.0 or later.
In Short: This extremely powerful hierarchical database has a mix of mainframe and PC interfaces. Its documentation is geared toward the corporate MIS department, but its screen painting, forms design, and report generator are first-rate. Dedicated database server computer required for network operation; no record locking necessary. Copy protected.

CIRCLE 660 ON READER SERVICE CARD

Q-Pro 4

Q-Pro 4 from QNE International, is a system developers' tool kit containing utilities and a fourth-generation language for creating applications. Using the menu-driven utilities, you paint screens, define data elements, and design reports that are the framework for your application. Then, with the more than 100 language com-

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■ NETWORKED DATABASES

PC MAGAZINE FACT FILE



***Q-Pro 4*, Version 4.0**
Q-N-E International Inc.
136 Granite Hill Ct.
Langhorne, PA 19047
(215) 968-5966
List Price: $90; $100 distribution license required for more than 1 user.
Requires: 256K RAM above network requirements, PC or PS/2 compatible, DOS 2.1 or later. Hard disk recommended.
In Short: This fourth-generation language has strong database tools and programmable file and record locking; you must understand record locking well before attempting it with *Q-Pro 4*. Not copy protected.

CIRCLE 659 ON READER SERVICE CARD

mands, you develop procedures that use the definitions and build the system. (The price of Version 4, reviewed here, was reduced to $90 plus a $100 distribution license when Version 5 was released. Version 5, which costs $795 per server plus a $250 distribution license, was not available for review at the time this article was written. For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 241.)

Q-Pro 4 supports both multiuser systems like MP/M and most networks using standard DOS 3.1 calls. Using the programming language, you can add commands to your procedures to lock both files and records. All locking conflicts are reported as runtime errors, requiring you to trap these errors and write other procedures to handle them.

To run *Q-Pro 4*, you must load BTSYS, a memory-resident B-tree file-handling module that requires a little over 100K of RAM. Networking software often requires 100 to 200K of RAM on its own, and the two together may cramp other software when *Q-Pro 4* is not in use. To avoid the problem, BTSYS has been set up with a non-memory-resident option that increases load times but frees up memory.

To activate *Q-Pro 4*'s networking capability, you must issue a HOST command that indicates the name of the network being used. Valid hosts include such operating systems as Novell's *NetWare*, IBM's *PC LAN*, Digital Research's *MP/M*, and others; *Q-Pro 4* supports any network using standard DOS 3.1 calls. Files opened after the HOST command is invoked cannot be opened by another user unless the keyword UNLOCKED is added to the OPEN statement. Even then, another keyword, R/O, can be added to limit access to the file.

Q-Pro 4 locks records with an RLOCK command that you place in your procedures file. It locks the current record and all others in the same disk sector until either another lock is attempted elsewhere or you issue the RUNLOCK command.

Locking errors are reported immediately, and the program will branch to the error routine indicated in the RLOCK command. An error number is placed in the #E variable so that you can test for one of four types of errors and either retry the lock or notify the user of a problem. To avoid some of the constant locking errors with active database files, *Q-Pro 4* allows you to specify the number of automatic retries with the LRETRY command.

Q-Pro 4 offers basic networking capabilities, but the programmer must anticipate every situation and write a routine to handle it. Although the program documentation is helpful, you need to understand record locking quite well before attempting it in *Q-Pro 4*.—**Mike Falkner**

R:base for DOS

At $725 for three users, $995 for six users, and $2,695 for an unlimited number of users on one server, *R:base for DOS* is yet another enhancement to Microrim's popular *R:base* database product. Reinforced with a better user interface, an SQL command subset, and speedier execution, *R:base for DOS* continues to tempt the *dBASE* world to take a second look. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 252.)

R:base runs on many network operating systems including Novell's *NetWare*, 3Com's *3+Share*, IBM's *PC LAN*, and others that use DOS 3.1 record-locking schemes. The *R:base* package is a set of separate modules (Forms Express, Reports Express, and so forth) that help you create sophisticated databases, reports, screens,



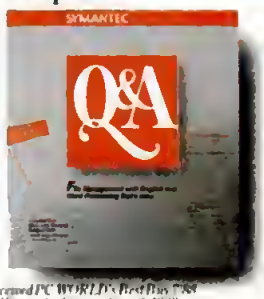
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and applications. To manipulate information, you can either enter English-like commands at a prompt or use command-by-example screens that help you build the command with menus. You have a full range of commands, functions, and query capabilities, and you can define macros and data security levels. Microrim also includes numerous tools such as FileGateway, a program that converts and manipulates files from other databases, and RBEdit, an effective text editor.

To initiate the network, you execute a bump program found on the Systems Administrator disk, which configures the server with the number of nodes allowed. You then add workstation names to the server by running ADDUSER, and you modify *R:base*'s default startup file to turn on the multiuser capability. Finally, you transfer the *R:base* program files from the server to each node.

R:base controls database, table, and column (field) locking automatically, and existing applications need not be rewritten to accommodate a network. Operations such as ALTER TABLE that affect the entire database lock it until the action is complete. *R:base* will also lock a table for commands such as FORMS and REPORTS and just a column for the commands EDIT USING and ENTER.

When *R:base* senses a lock condition, it notifies the users and tries to access the item again for a user-defined period of time (4 seconds is the default). If the request continues to fail, *R:base* will ask you if you want to abandon the action or try again. In all cases, other users can still view the locked information.

One of *R:base*'s most powerful network features is concurrency control. Unlike most databases, *R:base* will not lock an entire row (record) when you are using the EDIT USING or ENTER commands.



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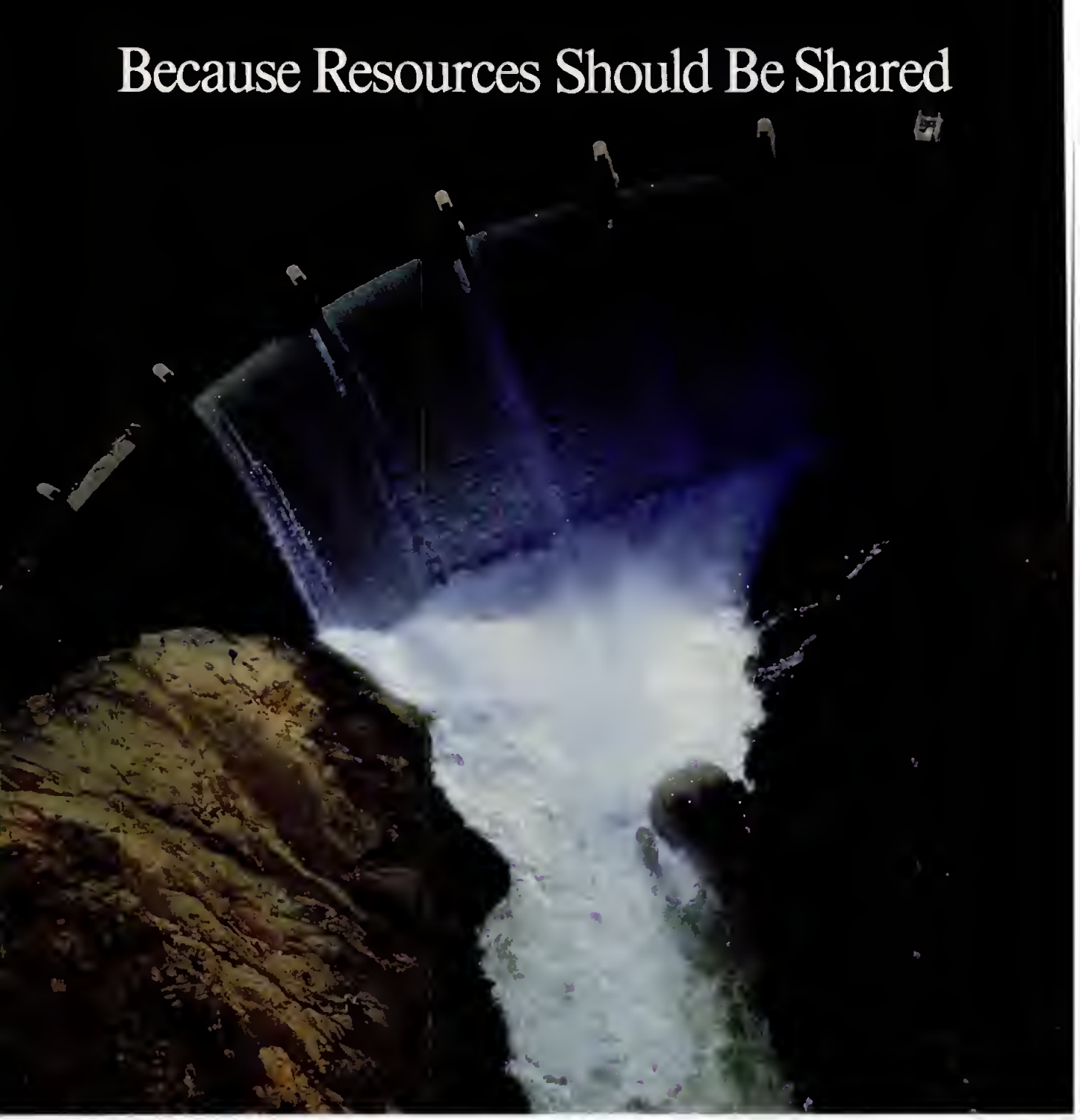
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R:base for DOS
Microrim
3925 159th Ave. NE
Redmond, WA 98073-9722
(206) 885-2000
List Price: $725 for 3 users; 4–6 users, $995; unlimited users, $2,695.
Requires: 640K RAM above network requirements, hard disk, PC or PS/2 compatible, DOS 3.1 or later.
In Short: This powerful database is loaded with sophisticated tools, good user interface, and excellent networking capabilities. Not copy protected.

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Instead, *R:base* notifies you only if the same column (field) is being changed, and you can accept the new value or use the one that you just entered. If you use the SET VERIFY ROW command, *R:base* will warn you if any column in the row has been modified, asking you whether it should accept your data or the other user's.

You can override some of *R:base*'s automatic locking to fine-tune your application. The SET LOCK ON command will force a table lock until SET LOCK OFF is issued. The SET WAIT command determines how long *R:base* will try to establish a lock, allowing applications to continue without constant errors. The Read-Modify security system lets you attach table and database passwords to control the read and write privileges to each. With the new version, *R:base* also added the SQL Grant-Revoke security system, a set of SQL commands that control five levels of access to tables and columns.

R:base continues to be a formidable competitor in the database world. And its networking capabilities are up there with the best. Except for its price tag and the need for bump disks, *R:base* is a relatively painless way to share data on a network.
—Mike Falkner

Team-Up

Team-Up, Version 2.0, from Unlimited Processing for $1,795 per server (ten nodes, $100 per node thereafter), comes standard with power everything—you just push a button to do almost anything. It might steer like a boat, but there is plenty of horsepower under the hood to get you where you want to go. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 256.)

The multiuser program works just about the same way as the single-user version works. The comprehensive manual explains both the relatively simple menu system and the more complex procedural language. You can use *Team-Up* to access data files directly or to create complete custom applications.

Installing *Team-Up* on a network is straightforward, thanks to the INSTALL program. The multiuser documentation explains the necessary MAP commands, and from there you simply turn to the standard documentation.

FACT FILE



***Team-Up*, Version 2.0**
Unlimited Processing Inc.
8382 Baymeadows Rd., #8
Jacksonville, FL 32256
(800) 874-8555
(904) 731-8330

List Price: $1,795 per server (ten nodes), $100 per node thereafter.
Requires: 140K RAM above network requirements, DOS 3.0 or later. Runs on any PC network–compatible system.
In Short: With powerful and complex capabilities packed into a small package of code, *Team-Up* offers some design features that should favor applications involving large databases with many users. Not copy protected.

CIRCLE 657 ON READER SERVICE CARD

The program executes most of the locking features automatically. If two users retrieve and modify the same record, only the first to execute the Update command will be recorded. When the second user attempts to Update, the program issues a message stating that the data has been changed since the last record read and then refreshes the screen to show the most current version of the record.

Team-Up also offers similar protection at the file level. You cannot perform certain operations, such as an index rebuild or restructure of a table, while the table is in use on another workstation. You can also invoke a variety of locking functions as part of the application language.

Team-Up is designed for large and complex applications and installations. It comes with an extensive security system that can control access right down to the field level and distinguish between different operations, including the various options on the menu system.

Team-Up can also find data and procedure files even when they are located on different shared disks or servers. This distribution can ease server loading in some cases. According to a company representative, the program can also undertake extremely efficient index searches; since it uses a modified B-tree design, it can find one record out of a million in six disk accesses or less. This can decrease the amount of information flowing across the network, thus improving performance.

If you should have a workstation crash, you are not likely to lose data. The most that will be lost is the record currently on the screen; in some cases, you may need to rebuild the table's index.

All these features are shoehomed into a program that takes up only 140K of memory. Since a 640K workstation must make room for DOS and network software in addition to the database program, *Team-Up*'s compact size can be a big advantage.

In sum, *Team-Up* gives you menu-driven access to data files in a way that may take some learning but is not particularly taxing. It also comes with a complex programming language, so that you can create custom multiuser applications. Some of *Team-Up*'s design features make it well suited for use in organizations that maintain large databases and have many users.
—Alfred Poor

Zim

Zim, Version 3.01, a fourth-generation relational database from Zanthe Information ($1580 for up to 4 users; $2,950 for up to 8 users; $4,120 for up to 16 users), is geared to the serious applications developer. It allows you to port program and data files from PC to minicomputer to mainframe environments, including MS-DOS, VM/CMS, VAX/VMS, UNIX, and Xenix. (For a review of the single-user version of the package, see *PC Magazine*, May 17, 1988, page 270.)

One *Zim* module, the Development Assistant (Zim/DA), gives developers an application generator, menu generator, data dictionary, report painter, code editors, and context-sensitive help. *Zim* uses a nontraditional approach to data file structure: an entity set structure.

Because of *Zim*'s approach to multiuser database access, applications written for a single-user environment may require reprogramming. You must explicitly define record updates as "transactions" so that the system knows precisely when to lock the record and at what point the transaction is performed. This design places the burden of transaction security on the program-

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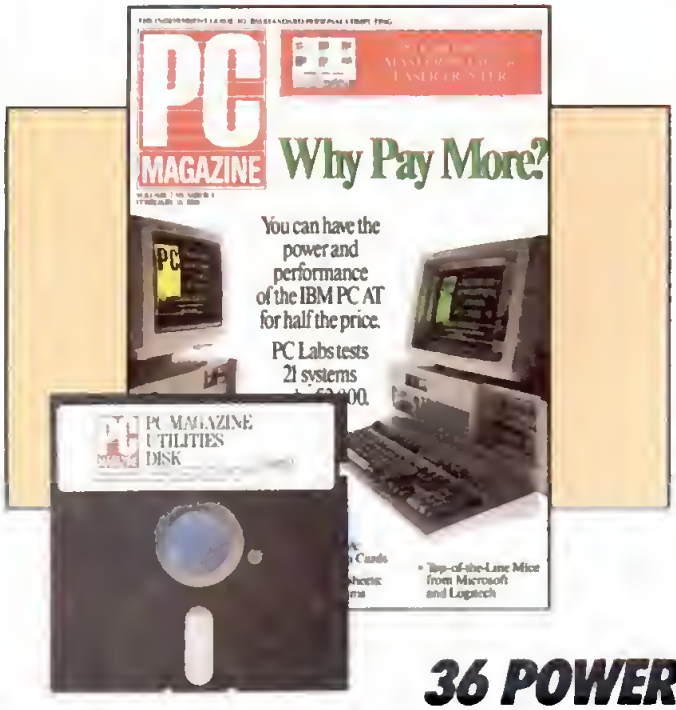
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mer. On the other hand, it gives the programmer complete control over record security by tailoring record access and locking to the applications. Programs written in *Zim* for multiuser environments can also run as single-user applications under MS-DOS without modification.

A prime benefit of *Zim*'s record-locking scheme is the elimination of deadlock situations. Deadlock occurs when two users attempt to access the same data and each requires information held by the other to complete the transaction. As a result, each user waits indefinitely for the other to finish. *Zim* recognizes when these situations occur, waits a reasonable time for the update to be completed, and if the time expires, aborts one of the user's transactions. In that case, one transaction is lost, but database integrity is maintained.

Zim describes this approach to transaction security as "two-phase" locking. In two-phase locking, locks are accumulated until the end of the transaction, whereupon all locks are released as a group. This locking scheme supports serialization and transaction back out.

Users gain access to a particular database by executing the ZimMU (full development multiuser), ZimRTMU (runtime multiuser), or ZimQRTMU (query only, runtime multiuser) commands while pointing to a directory containing a file called config.zim. The config.zim file tells *Zim* where to find the database files and sets a path to the user's work file directory, where temporary files are stored. For example, if two users require access to two separate databases, four directories need to be established, each containing the appropriate config.zim file; access by four users to three databases would require 12 directories to be created.

Protecting the database from hardware or operating system errors is virtually assured by *Zim* when running under Novell's *NetWare* with Transaction Tracking System (TTS). In addition, *Zim* has a recovery utility that uses the transaction audit trails to rebuild the database.

Zim offers an add-on security option called the Zim Security Module, which allows the creation of a data dictionary of users and groups for later use in data access privileges. The system can also use the user and group IDs assigned through the operating system. *Zim* assigns a permission mask to all directories, to all entity sets and relationships, and to all fields in entity sets and relationships. Data encryption is also available, although it may slow the system's performance.

In a LAN environment, some *Zim* data files can reside locally on a workstation disk. For instance, one user could have a customer lookup file containing customers in the Northeast and another could have a file for only Midwest customers.

If your development efforts demand highly flexible, advanced treatment of multiuser access, *Zim* is an excellent choice. But beware: using this industrial-strength software requires a thorough understanding of multiuser database programming.—**Glenn C. McPeak** PC

PC MAGAZINE EDITOR'S CHOICE

- **Clarion Professional Developer**
- **DataEase LAN**

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If you are looking for a more complex development environment, consider the Clarion Professional Developer. *It is almost easy enough for a novice to use, thanks to its powerful and intelligent code-generating module, but programmers will find that its editor and full-featured procedural language gives them plenty of room to maneuver. This alone makes it a a good value, but* Clarion *will also compile standalone .EXE programs that require no runtime modules or royalty payments, making it especially attractive to developers and corporate programmers.*

Many other fine products are found in this collection, but three runners-up deserve special mention. Paradox *is especially suited for those whose primary experience with databases has been* Lotus 1-2-3 *data ranges, and* FoxBASE Plus/LAN *is the best of the* dBASE *clones.* PC-Focus *will be of interest to any companies running* Focus *on their mainframe; it also merits recognition for its database server design, which should make for improved performance on most networks.*

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***Zim*, Version 3.01**
Zanthe Information Inc.
1200-38 Antares Dr.
Ottawa, Ontario,
Canada, K2E 7V2
(800) 267-9972
(613) 727-1397
List Price: $1,580 for up to 4 users; $2,950 for up to 8 users; $4,120 for up to 16 users.
Requires: 640K RAM, hard disk, DOS 2.0 or later.
In Short: This sophisticated applications development tool was designed with the multiuser environment in mind; it is not intended for developers who lack solid knowledge of multiuser applications programming. Not copy protected.

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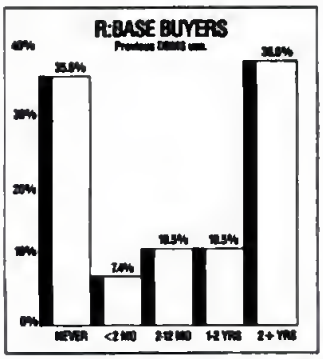
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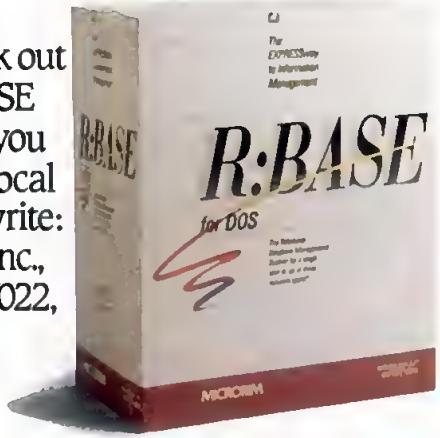
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THE TINIEST EDITOR YOU'LL EVER NEED

For small editing jobs, a word processor is overkill and EDLIN is still as hard to remember as the last time you used it. TED is tiny, easy, full-screen, and fast.

What do you keep on your emergency floppy? Besides a bootable system, you probably have copies of CHKDSK, FDISK, FORMAT, SYS, MODE, DEBUG, and your favorite file rescue utility. But what do you use to change AUTOEXEC.BAT or CONFIG.SYS, or to create a couple of quick batch files?

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If you supply an input *filespec* (filename, plus drive and path if required), TED will read and display the file. Should you omit this optional parameter, TED will open a new file and prompt you for its name when you press F7 to save the file and exit. As with EDLIN, when you save a modified file the original is renamed with the extension .BAK. (Of course, if you edit a .BAK file you will not have a backup copy.) To abandon your edit and leave the original file intact, press F1 to Abort and exit without saving your changes.

Entering text in TED is similar to using a typewriter. Unlike using one of today's word processors, which generally implement automatic word wrap, you have to hit Enter to end each line. TED is an editor, not a full-scale word processor, and it deals with files a line at a time.

Each line occupies a single row on the screen. There is no limit on line length, *but* lines longer than the screen width cannot be displayed all at once. When there are characters on a line in the file that don't fit on the screen, a diamond is shown in the far right column to indicate the extended line. If you want to split the long line, simply move the cursor to a convenient point and press Enter. Text to the right of the cursor will be transferred to the new line. To join two lines, move to the end of a line and press the Del key.

TED defaults to insert mode for entering characters; as you type, any following text is moved forward to make room for the new letters. Pressing the Ins key toggles you into overstrike mode, in which existing characters are written over by the typed text. An "I" is displayed in the bottom-right corner of the screen for insert mode, and an "O" for overstrike mode.

KEYPAD COMMANDS The keypad keys all have their natural functions. Figure 1 contains a complete list. The Right Arrow key and Left Arrow key move the cursor a character at a time.

PRODUCTIVITY INDEX

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TED is a small, full-screen editor that's fast and easy to use.
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The PM's standardized overhead provides display flexibility.
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Four assembler routines to compare, search, and validate strings.
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The best ways to calculate the interest rate for a loan.
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Copying blocks of *WordPerfect* text; backing up large *dBASE* files.
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Generate numbered C listings; embed control codes in FORTRAN strings.
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Are there really any new ideas—a look at the PC marketplace.
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Configuring a small, economical LAN; tracking *NetWare* activity.

Keypad Commands

Key	Description
Up Arrow	Moves cursor up one row
Down Arrow	Moves cursor down one row
Left Arrow	Moves cursor left one column
Right Arrow	Moves cursor right one column
PgUp	Moves text window up one page
PgDn	Moves text window down one page
Home	Moves cursor to start of row
End	Moves cursor to end of row
Ins	Toggles insert/ overstrike mode
Del	Deletes character at cursor
Ctrl–PgUp	Moves to top of file
Ctrl–PgDn	Moves to bottom of file
Ctrl–Right Arrow	Moves text window right eight columns
Ctrl–Left Arrow	Moves text window left eight columns

Figure 1: *Keypad keys are used to position the cursor and scroll the display.*

The Ctrl–Left Arrow and Ctrl–Right Arrow keys shift the display sideways, allowing you to edit lines too long to fit on the screen. Each shift moves the display by eight columns (the width of one tab character). The limit on side shift is 248 columns, so if you have to edit any lines longer than this, you'll have to temporarily break them into shorter chunks.

The PgUp and PgDn keys move the cursor a "page" at a time. A page here is equal to the number of rows on the screen minus five. The slight overlap makes it easier to keep track of your position while paging through a file. To move quickly to the start or end of a file, use Ctrl-PgUp or Ctrl-PgDn. Home and End take you to the start or end of the current line.

Like DOS, TED lets you enter any character by holding down the Alt key, typing its ASCII code on the numeric keypad, then releasing Alt. This gives you access both to nonprinting codes below ASCII 32 and to the upper-order (ASCII 128 to 255) characters in the IBM set.

TED follows the normal text conventions: pressing Enter actually adds two characters, Carriage Return (ASCII 13) and Line Feed (ASCII 10); the Tab key inserts the ASCII 9 tab character and advances the cursor to the next column that is an even multiple of eight; the backspace deletes the character to its immediate left ("destructive" backspace) and combines two lines if it is pressed while in the first column.

THE FUNCTION KEYS The function key editing assignments are shown in abbreviated form at the bottom of the screen and are summarized in Figure 2. Since any changes you've made are lost if you press ABORT (F1), you are prompted to verify your intentions by pressing "Y". Any other key returns control to the editor.

Use EXIT (F7) to save your edits to a file. TED will prompt for a filename, offering the input file as a default. You can press Enter to accept it, or erase it with Backspace and enter a new name. When saving, if an invalid filename is specified, the editor beeps in protest and returns you to the editor mode. Similarly, any error while writing the file (such as a full disk) results in being returned to the editor. At this point, you can attempt saving to a different disk or just quit. If you should press F7 (EXIT) by accident, pressing Esc also returns you to the editor.

The PRINT (F3) command is used in conjunction with the MARK function (F4) to print anything from a single word to the entire file. To start, place the cursor at the beginning of the region to be selected and press F4. Now, as you move the cursor with any of the cursor movement keys, the marked region will appear in inverse video. If you need to cancel the mark, just press F4 again; the display will return to normal and the mark will be erased.

To print a marked area, just hit F3. When printing stops, the mark state is reset to off. To avoid getting stuck by a sick printer, TED checks continuously for printer errors. Should one occur, printing is stopped and normal editing resumes.

MARK (F4) is also used with CUT (F5) and PASTE (F6) to let you copy, delete, and move entire sections of your file. These commands employ an internal paste buffer (sometimes known as a clipboard), which can be inserted at any point in the file.

Editing Functions

Function	Key	Operation
ABORT	F1	Exits without saving changes
UNDO	F2	Replaces recently deleted characters
PRINT	F3	Prints the marked text
MARK	F4	Toggles mark state on/off
CUT	F5	Moves marked text to paste buffer
PASTE	F6	Inserts contents of paste buffer
EXIT	F7	Saves changes and exits
DEL EOL	F8	Deletes from cursor to the end of line
DEL L	F9	Deletes the current line
UDEL L	F10	Inserts the last deleted line

Figure 2: *The editing function keys are used to operate on blocks of text.*

After marking a range of text, press F5 (CUT) to remove this section from the file and transfer it to the paste buffer. If you intend to *copy* the marked text, immediately press F6 (PASTE) to replace it in the original position. Then move the cursor to the next location for the marked section and PASTE again. You can do this as many times as you like, making it a snap to duplicate words or entire sections of the file. The contents of the paste buffer are available until you use the CUT function again.

A second buffer is used by TED's UNDO (F2) command. If, for example, you've just typed a sentence into an important letter only to discover—too late—that the editor is in overstrike mode, simply press F2. The text you've just typed over will magically reappear. Similarly, text that is deleted with the Del key (but *not* with the Backspace key) can be brought back. Just be sure to use UNDO *immedi-*

mer. On the other hand, it gives the programmer complete control over record security by tailoring record access and locking to the applications. Programs written in *Zim* for multiuser environments can also run as single-user applications under MS-DOS without modification.

A prime benefit of *Zim*'s record-locking scheme is the elimination of deadlock situations. Deadlock occurs when two users attempt to access the same data and each requires information held by the other to complete the transaction. As a result, each user waits indefinitely for the other to finish. *Zim* recognizes when these situations occur, waits a reasonable time for the update to be completed, and if the time expires, aborts one of the user's transactions. In that case, one transaction is lost, but database integrity is maintained.

Zim describes this approach to transaction security as "two-phase" locking. In two-phase locking, locks are accumulated until the end of the transaction, whereupon all locks are released as a group. This locking scheme supports serialization and transaction back out.

Users gain access to a particular database by executing the ZimMU (full development multiuser), ZimRTMU (runtime multiuser), or ZimQRTMU (query only, runtime multiuser) commands while pointing to a directory containing a file called config.zim. The config.zim file tells *Zim* where to find the database files and sets a path to the user's work file directory, where temporary files are stored. For example, if two users require access to two separate databases, four directories need to be established, each containing the appropriate config.zim file; access by four users to three databases would require 12 directories to be created.

Protecting the database from hardware or operating system errors is virtually assured by *Zim* when running under Novell's *NetWare* with Transaction Tracking System (TTS). In addition, *Zim* has a recovery utility that uses the transaction audit trails to rebuild the database.

Zim offers an add-on security option called the Zim Security Module, which allows the creation of a data dictionary of users and groups for later use in data access privileges. The system can also use the user and group IDs assigned through the operating system. *Zim* assigns a permission mask to all directories, to all entity sets and relationships, and to all fields in entity sets and relationships. Data encryption is also available, although it may slow the system's performance.

In a LAN environment, some *Zim* data files can reside locally on a workstation disk. For instance, one user could have a customer lookup file containing customers in the Northeast and another could have a file for only Midwest customers.

If your development efforts demand highly flexible, advanced treatment of multiuser access, *Zim* is an excellent choice. But beware: using this industrial-strength software requires a thorough understanding of multiuser database programming.—**Glenn C. McPeak**

EDITOR'S CHOICE

- **Clarion Professional Developer**
- **DataEase LAN**

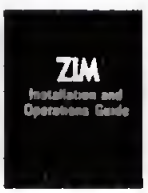
Only a few short years ago, running a database program on a local area network was a risky business. But now there are many solid products from which you can safely choose. And two of them stand out from the pack.

If you are new to local area networks or multiuser databases, DataEase LAN *makes it as painless as possible to get up and running. You can use the default settings to get a system that works straight out of the box. Though there are plenty of features available that you can use to build custom applications, it also works just fine in its menu-driven mode.*

If you are looking for a more complex development environment, consider the Clarion Professional Developer. *It is almost easy enough for a novice to use, thanks to its powerful and intelligent code-generating module, but programmers will find that its editor and full-featured procedural language gives them plenty of room to maneuver. This alone makes it a a good value, but* Clarion *will also compile stand-alone .EXE programs that require no runtime modules or royalty payments, making it especially attractive to developers and corporate programmers.*

Many other fine products are found in this collection, but three runners-up deserve special mention. Paradox *is especially suited for those whose primary experience with databases has been* Lotus 1-2-3 *data ranges, and* FoxBASE Plus/LAN *is the best of the* dBASE *clones.* PC-Focus *will be of interest to any companies running* Focus *on their mainframe; it also merits recognition for its database server design, which should make for improved performance on most networks.*

FACT FILE



***Zim*, Version 3.01**
Zanthe Information Inc.
1200-38 Antares Dr.
Ottawa, Ontario,
Canada, K2E 7V2
(800) 267-9972
(613) 727-1397
List Price: $1,580 for up to 4 users; $2,950 for up to 8 users; $4,120 for up to 16 users.
Requires: 640K RAM, hard disk, DOS 2.0 or later.
In Short: This sophisticated applications development tool was designed with the multiuser environment in mind; it is not intended for developers who lack solid knowledge of multiuser applications programming. Not copy protected.

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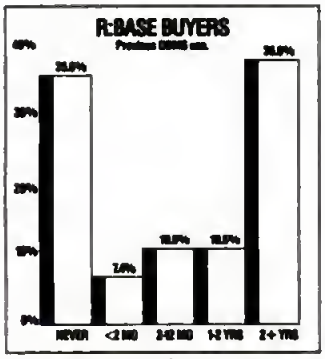
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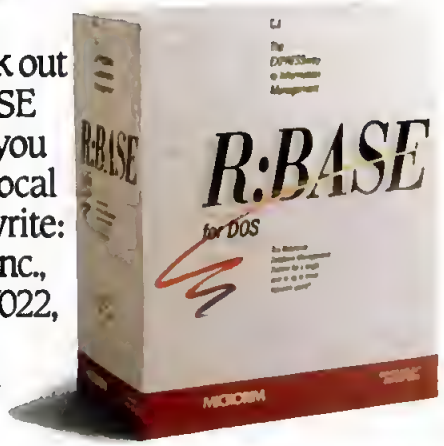
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And Peachtree Complete II is designed using the latest software innovations, like full-color scrolling reference tables, pop-up windows, and short-cut keyed menus. We've increased numeric capacities as high as $999,999,999.99 in key areas, added Service Invoicing, included Range Printing, and expanded to allow an unlimited number of companies.

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If you supply an input *filespec* (filename, plus drive and path if required), TED will read and display the file. Should you omit this optional parameter, TED will open a new file and prompt you for its name when you press F7 to save the file and exit. As with EDLIN, when you save a modified file the original is renamed with the extension .BAK. (Of course, if you edit a .BAK file you will not have a backup copy.) To abandon your edit and leave the original file intact, press F1 to Abort and exit without saving your changes.

Entering text in TED is similar to using a typewriter. Unlike using one of today's word processors, which generally implement automatic word wrap, you have to hit Enter to end each line. TED is an editor, not a full-scale word processor, and it deals with files a line at a time.

Each line occupies a single row on the screen. There is no limit on line length, *but* lines longer than the screen width cannot be displayed all at once. When there are characters on a line in the file that don't fit on the screen, a diamond is shown in the far right column to indicate the extended line. If you want to split the long line, simply move the cursor to a convenient point and press Enter. Text to the right of the cursor will be transferred to the new line. To join two lines, move to the end of a line and press the Del key.

TED defaults to insert mode for entering characters; as you type, any following text is moved forward to make room for the new letters. Pressing the Ins key toggles you into overstrike mode, in which existing characters are written over by the typed text. An "I" is displayed in the bottom-right corner of the screen for insert mode, and an "O" for overstrike mode.

KEYPAD COMMANDS The keypad keys all have their natural functions. Figure 1 contains a complete list. The Right Arrow key and Left Arrow key move the cursor a character at a time.

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■ UTILITIES

Keypad Commands

Key	Description
Up Arrow	Moves cursor up one row
Down Arrow	Moves cursor down one row
Left Arrow	Moves cursor left one column
Right Arrow	Moves cursor right one column
PgUp	Moves text window up one page
PgDn	Moves text window down one page
Home	Moves cursor to start of row
End	Moves cursor to end of row
Ins	Toggles insert/ overstrike mode
Del	Deletes character at cursor
Ctrl–PgUp	Moves to top of file
Ctrl–PgDn	Moves to bottom of file
Ctrl–Right Arrow	Moves text window right eight columns
Ctrl–Left Arrow	Moves text window left eight columns

Figure 1: *Keypad keys are used to position the cursor and scroll the display.*

The Ctrl–Left Arrow and Ctrl–Right Arrow keys shift the display sideways, allowing you to edit lines too long to fit on the screen. Each shift moves the display by eight columns (the width of one tab character). The limit on side shift is 248 columns, so if you have to edit any lines longer than this, you'll have to temporarily break them into shorter chunks.

The PgUp and PgDn keys move the cursor a "page" at a time. A page here is equal to the number of rows on the screen minus five. The slight overlap makes it easier to keep track of your position while paging through a file. To move quickly to the start or end of a file, use Ctrl-PgUp or Ctrl-PgDn. Home and End take you to the start or end of the current line.

Like DOS, TED lets you enter any character by holding down the Alt key, typing its ASCII code on the numeric keypad, then releasing Alt. This gives you access both to nonprinting codes below ASCII 32 and to the upper-order (ASCII 128 to 255) characters in the IBM set.

TED follows the normal text conventions: pressing Enter actually adds two characters, Carriage Return (ASCII 13) and Line Feed (ASCII 10); the Tab key inserts the ASCII 9 tab character and advances the cursor to the next column that is an even multiple of eight; the backspace deletes the character to its immediate left ("destructive" backspace) and combines two lines if it is pressed while in the first column.

THE FUNCTION KEYS The function key editing assignments are shown in abbreviated form at the bottom of the screen and are summarized in Figure 2. Since any changes you've made are lost if you press ABORT (F1), you are prompted to verify your intentions by pressing "Y". Any other key returns control to the editor.

Use EXIT (F7) to save your edits to a file. TED will prompt for a filename, offering the input file as a default. You can press Enter to accept it, or erase it with Backspace and enter a new name. When saving, if an invalid filename is specified, the editor beeps in protest and returns you to the editor mode. Similarly, any error while writing the file (such as a full disk) results in being returned to the editor. At this point, you can attempt saving to a different disk or just quit. If you should press F7 (EXIT) by accident, pressing Esc also returns you to the editor.

The PRINT (F3) command is used in conjunction with the MARK function (F4) to print anything from a single word to the entire file. To start, place the cursor at the beginning of the region to be selected and press F4. Now, as you move the cursor with any of the cursor movement keys, the marked region will appear in inverse video. If you need to cancel the mark, just press F4 again; the display will return to normal and the mark will be erased.

To print a marked area, just hit F3. When printing stops, the mark state is reset to off. To avoid getting stuck by a sick printer, TED checks continuously for printer errors. Should one occur, printing is stopped and normal editing resumes.

MARK (F4) is also used with CUT (F5) and PASTE (F6) to let you copy, delete, and move entire sections of your file. These commands employ an internal paste buffer (sometimes known as a clipboard), which can be inserted at any point in the file.

Editing Functions

Function	Key	Operation
ABORT	F1	Exits without saving changes
UNDO	F2	Replaces recently deleted characters
PRINT	F3	Prints the marked text
MARK	F4	Toggles mark state on/off
CUT	F5	Moves marked text to paste buffer
PASTE	F6	Inserts contents of paste buffer
EXIT	F7	Saves changes and exits
DEL EOL	F8	Deletes from cursor to the end of line
DEL L	F9	Deletes the current line
UDEL L	F10	Inserts the last deleted line

Figure 2: *The editing function keys are used to operate on blocks of text.*

After marking a range of text, press F5 (CUT) to remove this section from the file and transfer it to the paste buffer. If you intend to *copy* the marked text, immediately press F6 (PASTE) to replace it in the original position. Then move the cursor to the next location for the marked section and PASTE again. You can do this as many times as you like, making it a snap to duplicate words or entire sections of the file. The contents of the paste buffer are available until you use the CUT function again.

A second buffer is used by TED's UNDO (F2) command. If, for example, you've just typed a sentence into an important letter only to discover—too late—that the editor is in overstrike mode, simply press F2. The text you've just typed over will magically reappear. Similarly, text that is deleted with the Del key (but *not* with the Backspace key) can be brought back. Just be sure to use UNDO *immedi-*

```
;=============================================================================
;  TED.ASM -- The Tiny Editor.
;  PC Magazine * Tom Rihikes * 11/15/88
;-----------------------------------------------------------------------------
CSEG            SEGMENT
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG
                ORG     100H            ;Beginning for .COM programs
START:
                JMP     BEGIN

;-----------------------------------------------------------------------------
; Local data area
;-----------------------------------------------------------------------------
TAB             EQU     9
CR              EQU     13
LF              EQU     10

COPYRIGHT       DB      CR,LF,"TED 1.0 (C) 1988 Kiff Communications Co."
                DB      CR,LF,"PC Magazine ",254," Tom Kihikes$",1AH

FILE_TOO_BIG    DB      "File too big$"
READ_ERR_MESS   DB      "Read error$"
MEMORY_ERROR    DB      "Not enough memory$"

PROMPT_STRING   DB      "1ABORT",0,"2UNDO",0,"3PRINT",0
                DB      "4MARK",0,"5CUT",0,"6PASTE",0,"7EXIT",0
                DB      "8DEL EOL",0,"9DEL L",0,"10UDEL L",0,0
PROMPT_LENGTH   =       $ - OFFSET PROMPT_STRING

VERIFY_MESS     DB      "Lose Changes (Y/N)?",0
SAVE_MESS       DB      "Save as: ",0
DOT_DOS         DB      ".$$$",0
DOT_BAK         DB      ".BAK",0
DIRTY_BITS      DB      1
NORMAL          DB      07H
INVERSE         DB      70H
LEFT_MARGIN     DB      0
MARGIN_COUNT    DB      0
INSERT_MODE     DB      -1
MARK_MODE       DB      0
ROWS            DB      23
SAVE_COLUMN     DB      0
SAVE_ROW        DB      0
LINE_FLAG       DB      0
EVEN
NAME_POINTER    DW      81H
NAME_END        DW      81H
STATUS_REG      DW      ?
VIDEO_SEG       DW      0B000H
LINE_LENGTH     DW      0
UNDO_LENGTH     DW      0
CUR_POSS        DW      0
MARK_START      DW      0FFFFH
MARK_END        DW      0
MARK_HOME       DW      0
TOP_OF_SCREEN   DW      0
CURROW          DW      0
LAST_CHAR       DW      0
COLUMNS         LABEL   BYTE
COLUMNW         DW      ?
PASTE_SEG       DW      ?
PASTE_SIZE      DW      0
PAGE_PROC       DW      ?
OLDINT24        DD      ?
DISPATCH_TABLE  DW      OFFSET ABORT    ,OFFSET UNDO    ,OFFSET PRINT
                DW      OFFSET MARK     ,OFFSET CUT     ,OFFSET PASTE
                DW      OFFSET EXIT     ,OFFSET DEL_EOL,OFFSET DEL_L
                DW      OFFSET UDEL_L   ,OFFSET BAD_KEY,OFFSET BAD_KEY
                DW      OFFSET HOME     ,OFFSET UP      ,OFFSET PGUP
                DW      OFFSET BAD_KEY  ,OFFSET LEFT    ,OFFSET BAD_KEY
                DW      OFFSET RIGHT    ,OFFSET BAD_KEY,OFFSET ENDD
                DW      OFFSET DOWN     ,OFFSET PGDN    ,OFFSET INSERT
                DW      OFFSET DEL_CHAR

; The following machine instruction removes the desnow delay.  It is
; inserted into the code for EGA, VGA, and MONO displays.

NO_DESNOW = 0E8H + (OFFSET WRITE_IT - OFFSET NWAIT - 2) * 256

;-----------------------------------------------------------------------------
; We start by initialize the display, then allocate memory for the file
; and paste segments.  Parse the command line for a filename, if one was
; input, read in the file.  Finally set the INT 23 and 24 vectors.
;-----------------------------------------------------------------------------
BEGIN:
                XOR     AX,AX
                MOV     DS,AX           ;Get a zero into DS
                ASSUME  DS:NOTHING
                MOV     AH,12H
                MOV     BL,10H          ;Get EGA info
                INT     10H
                CMP     BL,10H          ;Did BL change?
                JE      NOT_EGA         ;If not, no EGA in system
                TEST    BYTE PTR DS:[0487H],8   ;Is EGA active?
                JNZ     NOT_EGA
                MOV     WORD PTR CS:NWAIT,NO_DESNOW ;Get rid of desnow
                MOV     AX,DS:[0484H]   ;Get number of rows
                DEC     AL              ;Last row is for prompt line
                MOV     CS:[ROWS],AL    ;Save the number of rows
NOT_EGA:
                MOV     AX,DS:[044AH]   ;Get number of columns
                MOV     CS:COLUMNS,AH   ;and store it
                MOV     AH,DS:[0463H]   ;Address of display card
                ADD     AH,6            ;Add six to get status port
                PUSH    CS
                POP     DS
                ASSUME  DS:CSEG
                MOV     STATUS_REG,AX
                CMP     AH,3BAH         ;Is this a MONO display?
                JNZ     COLOR           ;If not, must be a CGA
                MOV     WORD PTR NWAIT,NO_DESNOW ;Get rid of desnow
                JMP     SHORT MOVE_STACK
COLOR:
                MOV     VIDEO_SEG,0B800H;Segment for color card
                XOR     BX,BX           ;Use page zero
                MOV     AH,8            ;Get current attribute
                INT     10H
                MOV     NORMAL,AH       ;Save the normal attribute
                XOR     AH,11101110B    ;Flip the color bits
                MOV     INVERSE,AH
MOVE_STACK:
                MOV     BX,OFFSET NEW_STACK
                MOV     SP,BX           ;Move the stack downward
                ADD     BX,15
                MOV     CL,4            ;Convert program size to
                SHR     BX,CL           ; paragraphs
                MOV     AH,4AH          ;Deallocate unused memory
                INT     21H
                MOV     BX,1000H        ;Request 64K for file segment
                MOV     AH,48H
                INT     21H
                MOV     PASTE_SEG,AX
                ASSUME  DS:FILE_SEG
                MOV     AH,48H
                INT     21H             ;Request 64K for paste buffer
                JNC     GOT_ENOUGH      ;If enough memory, continue
NOT_ENOUGH:
                MOV     DX,OFFSET MEMORY_ERROR
ERR_EXIT:
                PUSH    CS
                POP     DS
                MOV     AH,9            ;Write the error message
                INT     21H             ;DOS display service
                JMP     EXIT_TO_DOS     ;Exit this program
GOT_ENOUGH:
                MOV     PASTE_SEG,AX    ;Use this for the paste buffer
GET_FILENAME:
                MOV     SI,80H          ;Point to parameters
                MOV     CL,[SI]         ;Get number of characters
                XOR     CH,CH           ;Make it a word
                INC     SI              ;Point to first character
                PUSH    SI
                ADD     SI,CX           ;Point to last character
                MOV     BYTE PTR [SI],0 ;Make it an ASCII string
                MOV     NAME_END,SI     ;Save pointer to last character
                POP     SI              ;Get back pointer to filename
                CLD
                JCXZ    NO_FILENAME     ;If no params, just exit
DEL_SPACES:     LODSB                   ;Get character into AL
                CMP     AL," "          ;Is it a space?
                JNZ     FOUND_LETTER
                LOOP    DEL_SPACES
FOUND_LETTER:
                DEC     SI              ;Backup pointer to first letter
                MOV     NAME_POINTER,SI ;Save pointer to filename
                MOV     DX,SI
                MOV     AX,3D00H        ;Setup to open file
                INT     21H
                JC      NO_FILENAME     ;If we can't open, must be new file
FILE_OPENED:
                PUSH    DS
                POP     ES              ;ES has file segment also
                ASSUME  ES:FILE_SEG
                MOV     BX,AX           ;Get the handle into BX
                XOR     DX,DX           ;Point to file buffer
                MOV     AH,3FH          ;Read service
                MOV     CX,0FFFEH       ;Read almost 64K bytes
                INT     21H
                MOV     DI,AX           ;Number of bytes read is
                JNC     LOOK_FOR_EOF    ;If no error, take jump
                MOV     DX,OFFSET READ_ERR_MESS
                JMP     SHORT ERR_EXIT
LOOK_FOR_EOF:
                CMP     BYTE PTR [DI-1],1AH ;Was last char an EOF mark?
                JNZ     NO_EOF          ;If not, everything is OK
                DEC     DI              ;Backup to last character
NO_EOF:
                MOV     LAST_CHAR,DI    ;Save the file size
                CMP     CX,AX           ;Did the buffer fill?
                MOV     DX,OFFSET FILE_TOO_BIG
                JE      ERR_EXIT        ;If yes, it is too big
                MOV     AH,3EH          ;Close the file
                INT     21H
NO_FILENAME:
                PUSH    ES
                PUSH    ES              ;Save file segment
                MOV     AH,35H          ;Get INT 24 vector
                INT     21H
                MOV     WORD PTR OLDINT24,BX  ;Store the offset
                MOV     WORD PTR OLDINT24+2,ES;And the segment
                PUSH    CS
                POP     DS
                MOV     DX,OFFSET NEWINT24    ;Point to new vector
```

(continues)

TED.ASM: *You can assemble this source code to produce TED.COM, a full-screen editor whose small program size (less than 3K) makes it easy to put it on a bootable floppy disk or even in a RAMdisk.*

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■ UTILITIES

```
                MOV     AX,2526H        ;Now change INT 24 vector
                INT     21H

                MOV     DX,OFFSET NEWINT23
                MOV     AX,2523H        ;Set the INT 23 vector also
                INT     21H

                POP     ES              ;Get back file segment
                POP     DS
                ASSUME  DS:FILE_SEG, ES:FILE_SEG
                CALL    REDO_PROMPT     ;Draw the prompt line

;-----------------------------------------------------------------
; Here's the main loop.  It updates the screen, then reads a keystroke.
;-----------------------------------------------------------------
READ_A_KEY:
                CMP     MARK_MODE,0     ;Is the mark state on?
                JE      MARK_OFF        ;If not, skip this
                OR      DIRTY_BITS,4    ;Refresh the current row
                MOV     DX,CUR_POSN
                CMP     SAVE_ROW,DH     ;Are we on the save row?
                JE      SAME_ROW        ;If yes, then redo the row only
                MOV     DIRTY_BITS,1    ;Refresh the whole screen
SAME_ROW:
                MOV     AX,CURSOR       ;Get cursor location
                MOV     BX,MARK_HOME    ;Get the anchor mark position
                CMP     AX,BX           ;MOVing backward in file?
                JAE     N1
                MOV     MARK_START,AX   ;Switch start and end position
                MOV     MARK_END,BX
                JMP     SHORT MARK_OFF
N1:
                MOV     MARK_END,AX     ;Store start and end marks
                MOV     MARK_START,BX
MARK_OFF:
                MOV     DX,CUR_POSN
                MOV     HAVE_ROW,DX
                CALL    SET_CURSOR      ;Position the cursor
                TEST    DIRTY_BITS,1    ;Look at screen dirty bit
                JZ      SCREEN_OK       ;If zero, screen is OK

                MOV     AX,1            ;Get keyboard status
                INT     16H             ;Any keys ready?
                JNZ     CURRENT_OK      ;If yes, skip the update
                CALL    DISPLAY_SCREEN  ;Redraw the screen
                MOV     DIRTY_BITS,0    ;Mark screen as OK
SCREEN_OK:
                TEST    DIRTY_BITS,4    ;Is the current line dirty?
                JE      CURRENT_OK      ;If not, take jump
                CALL    DISPLAY_CURRENT ;Redraw the current line
                MOV     DIRTY_BITS,0    ;Mark screen as OK
CURRENT_OK:
                XOR     AH,AH           ;Read the next key
                INT     16H
                OR      AL,AL           ;Is this an extended code?
                JZ      EXTENDED_CODE
                CMP     AX,0EH          ;Was it the backspace key?
                JE      BACK_SPACE
                CALL    INSERT_KEY      ;Put this character in the file
                JMP     READ_A_KEY      ;Get another key
BACK_SPACE:
                CMP     CURSOR,0        ;At start of file?
                JE      BAD_KEY         ;If at start, can't backspace
                CALL    LEFT            ;Move left one space
                CALL    DEL_CHAR        ;And delete the character
                JMP     READ_A_KEY
EXTENDED_CODE:
                CMP     AX,84H          ;Is it control PgUp?
                JNE     NOT_TOP
                CALL    TOP
                JMP     READ_A_KEY
NOT_TOP:
                CMP     AX,76H          ;Is it control PgDn?
                JNE     NOT_BOTTOM
                CALL    BOTTOM
BAD_KEY:
                JMP     READ_A_KEY
NOT_BOTTOM:
                CMP     AX,73H          ;Is it control left arrow?
                JE      SH_LEFT
                CMP     AX,74H          ;Is it control right arrow?
                JE      SH_RIGHT
                CMP     AH,53H          ;Skip high numbered keys
                JA      BAD_KEY
                XCHG    AH,AL
                SUB     AL,3BH          ;Also skip low numbered keys
                JC      BAD_KEY
                SHL     AX,1            ;Make the code an offset
                MOV     BX,AX           ;Put offset in BX
                CALL    CS:DISPATCH_TABLE[BX] ;Call the key procedure
                JMP     READ_A_KEY      ;Then read another key

;-----------------------------------------------------------------
; These two routines shift the display right or left to allow editing
; files which contain lines longer than 80 columns.
;-----------------------------------------------------------------
SH_RIGHT        PROC    NEAR
                CMP     LEFT_MARGIN,255 - 8 ;Past max allowable margin?
                JAE     NO_SHIFT        ;Then can't move any more
                ADD     LEFT_MARGIN,8   ;This moves the margin over
SH_RETURN:
                CALL    CURSOR_COL      ;Compute column for cursor
                MOV     DX,CUR_POSN
                MOV     SAVE_COLUMN,DL  ;Save the current column
                MOV     DIRTY_BITS,1    ;Redraw the screen
NO_SHIFT:
                JMP     READ_A_KEY
SH_RIGHT        ENDP

SH_LEFT         PROC    NEAR
                CMP     LEFT_MARGIN,0   ;At start of line already?
                JE      NO_SHIFT        ;If yes, then don't shift
                SUB     LEFT_MARGIN,8   ;Move the window over
                JMP     SH_RETURN
SH_LEFT         ENDP

;-----------------------------------------------------------------
; This moves the cursor to the top of the file.
;-----------------------------------------------------------------
TOP             PROC    NEAR
                XOR     AX,AX           ;Get a zero into AX
                MOV     CURSOR,AX       ;Cursor to start of file
                MOV     TOP_OF_SCREEN,AX
                MOV     LEFT_MARGIN,AL  ;Move to far left margin
                MOV     DIRTY_BITS,1    ;Redraw the screen
                MOV     CUR_POSN,AX     ;Home the cursor
                MOV     SAVE_COLUMN,AL  ;Save the cursor column
                RET
TOP             ENDP

;-----------------------------------------------------------------
; This moves the cursor to the bottom of the file
;-----------------------------------------------------------------
BOTTOM          PROC    NEAR
                MOV     DX,NROWS        ;Get screen size
                MOV     SI,LAST_CHAR    ;Point to last character
                MOV     LEFT_MARGIN,0   ;Set window to start of line
                CALL    LOCATE          ;Adjust the screen position
                CALL    HOME            ;Move cursor to start of line
                MOV     DIRTY_BITS,1    ;This will redraw the screen
                RET
BOTTOM          ENDP

;-----------------------------------------------------------------
; This deletes from the cursor position to the end of line.
;-----------------------------------------------------------------
DEL_EOL         PROC    NEAR
                MOV     LINE_FLAG,0
                PUSH    CURSOR          ;Save starting cursor location
                CALL    ENDD            ;Move the the end of line
                POP     SI              ;Get back starting cursor
                MOV     CX,CURSOR       ;Offset of the end of line
                MOV     CURSOR,SI       ;Restore starting cursor
                JMP     DEL_RND         ;Delete characters to end
DEL_EOL         ENDP

;-----------------------------------------------------------------
; This deletes a line, placing it in the line buffer.
;-----------------------------------------------------------------
DEL_L           PROC    NEAR
                MOV     LINE_FLAG,1
                CALL    FIND_START      ;Find start of this line
                MOV     CURSOR,SI       ;This will be the new cursor
                PUSH    SI              ;Save the cursor position
                CALL    FIND_NEXT       ;Find the next line
                MOV     CX,SI           ;CX will hold line length
                POP     SI              ;Get back new cursor location
DEL_END:
                SUB     CX,SI           ;Number of bytes on line
                OR      CH,CH           ;Is line too long to fit
                JZ      NOT_TOO_LONG
                MOV     CX,100H         ;Only save 256 characters
NOT_TOO_LONG:
                MOV     LINE_LENGTH,CX  ;Store length of deleted line
                JCXZ    NO_DEL_L
                MOV     DI,OFFSET LINE_BUFFER ;Buffer for deleted line

                PUSH    CX
                PUSH    ES
                PUSH    CS
                POP     ES              ;Line buffer is in CSEG
                REP     MOVSB           ;Put deleted line in buffer
                POP     ES              ;Get back file segment
                POP     AX

                MOV     CX,LAST_CHAR    ;Get the file size
                SUB     LAST_CHAR,AX    ;Subtract the deleted line
                MOV     DI,CURSOR       ;Get new cursor location
                MOV     SI,DI
                ADD     DI,AX           ;SI points to end of file
                SUB     CX,DI           ;Length of remaining file
                JCXZ    NO_DEL_L
                REP     MOVSB           ;Shift remainder of file up
NO_DEL_L:
                MOV     DX,CUR_POSN     ;Get cursor row/column
                MOV     DI,CURSOR       ;Get cursor offset
                CALL    LOCATE          ;Adjust the screen position
                MOV     DIRTY_BITS,1    ;Redraw the screen
                RET
DEL_L           ENDP

;-----------------------------------------------------------------
; This undeletes a line by copying it from the line buffer into the file
;-----------------------------------------------------------------
UDEL_L          PROC    NEAR
                CMP     LINE_FLAG,0     ;Is this an end of line only?
                JE      UDEL_EOL        ;If yes, don't home the cursor
                CALL    HOME            ;Move cursor to home
UDEL_EOL:
                MOV     AX,LINE_LENGTH  ;Length of deleted line
                MOV     SI,OFFSET LINE_BUFFER
                JMP     INSERT_STRING
UDEL_L          ENDP
```

(TED.ASM continues)

■ UTILITIES

```
;-----------------------------------------------------------------
; These routines move the cursor left and right.
;-----------------------------------------------------------------
LEFT            PROC    NEAR
                CMP     CURSOR,0        ;At start of file?
                JE      LN_NO_CHANGE    ;Then can't move left
                MOV     DX,CUR_POSN
                OR      DL,DL           ;At first column?
                JZ      MOVE_UP         ;If yes, then move up one
                DEC     CURSOR          ;Shift the cursor offset
LR_RETURN:
                CALL    CURSOR_COL      ;Compute column for cursor
                MOV     SAVE_COLUMN,DL  ;Save the cursor column
LR_NO_CHANGE:
                MOV     UNDO_LENGTH,0
                RET
MOVE_UP:
                CALL    UP              ;Move up to next row
                JMP     SHORT END0      ;And move to end of line
LEFT            ENDP

RIGHT           PROC    NEAR
                MOV     BX,CURROR
                CMP     BX,LAST_CHAR    ;At end of file?
                JE      LN_NO_CHANGE    ;If yes, then can't move
                CMP     BYTE PTR [BX],CR;At end of line?
                JE      MOVE_DOWN       ;If yes, then move down
                INC     CURSOR          ;Advance the cursor
                JMP     LR_RETURN
MOVE_DOWN:
                CALL    HOME            ;Move to start of line
                JMP     DOWN            ;And move down one row
RIGHT           ENDP

;-----------------------------------------------------------------
; This moves the cursor to the start of the current line.
;-----------------------------------------------------------------
HOME            PROC    NEAR
                CALL    FIND_START      ;Find start of line
                MOV     CURSOR,SI       ;Save the new cursor
                MOV     SAVE_COLUMN,0   ;Save the cursor column
                MOV     BYTE PTR CUR_POSN,0 ;Store column number
                RET
HOME            ENDP

;-----------------------------------------------------------------
; This moves the cursor to the end of the current line
;-----------------------------------------------------------------
END0            PROC    NEAR
                MOV     BX,CURROR
                CALL    FIND_EOL        ;Find end of this line
                MOV     CURSOR,BX       ;Store the new cursor
                CALL    CURROR_COL      ;Compute the correct column
                MOV     SAVE_COLUMN,DL  ;Save the cursor column
                RET
END0            ENDP

;-----------------------------------------------------------------
; This moves the cursor up one row.  If the cursor is at the first row,
; the screen is scrolled down.
;-----------------------------------------------------------------
UP              PROC    NEAR
                MOV     UNDO_LENGTH,0
                MOV     DX,CUR_POSN
                MOV     BX,CURSOR
                OR      DH,DH           ;At top row already?
                JZ      SCREEN_DN       ;If yes, then scroll down
                DEC     DH              ;Move cursor up one row
                CALL    FIND_CR         ;Find the beginning of this row
                MOV     CURSOR,BX
                CALL    FIND_START      ;Find start of this row
                MOV     CURSOR,BX
                CALL    SHIFT_RIGHT     ;Skip over to current column
AT_TOP:
                RET
SCREEN_DN:
                MOV     BX,TOP_OF_SCREEN
                OR      BX,BX           ;At start of file?
                JE      AT_TOP          ;If at top, then do nothing
                CALL    FIND_PREVIOUR   ;Find the preceeding line
                MOV     TOP_OF_SCREEN,BX;Save new top of screen
                MOV     BX,CURSOR
                CALL    FIND_PREVIOUR   ;Find the preceeding line
                MOV     CURSOR,BX       ;This is the new cursor
SHIFT_RET:
                MOV     DIRTY_BITS,1    ;Need to redraw screen
                MOV     BX,CURSOR
                MOV     DX,CUR_POSN
                JMP     SHIFT_RIGHT     ;Move cursor to current column
UP              ENDP

;-----------------------------------------------------------------
; This moves the cursor down one row.  When the last row is reached,
; the screen is shifted up one row.
;-----------------------------------------------------------------
DOWN            PROC    NEAR
                MOV     UNDO_LENGTH,0
                MOV     DX,CUR_POSN
                CMP     DH,NUMS         ;At bottom row already?
                MOV     BX,CURSOR       ;Get position in file
                JE      SCREEN_UP       ;If at bottom, then scroll up
                CALL    FIND_NEXT       ;Find the start of next line
                JC      DOWN_RET        ;If no more lines, then return
                MOV     CURSOR,BX
                INC     DH              ;Advance cursor to next row
                CALL    SHIFT_RIGHT     ;Move cursor to current column
DOWN_RET:
                RET

SCREEN_UP:
                CMP     BX,LAST_CHAR    ;Get cursor offset
                JE      DOWN_RET
                CALL    FIND_START      ;Find the start of this line
                MOV     CURSOR,BX       ;This is the new cursor
                CALL    FIND_NEXT       ;Find the offset of next line
                JC      SHIFT_RET       ;If no more lines then return
                MOV     CURSOR,BX       ;This is the new cursor
                MOV     BX,TOP_OF_SCREEN;Get the start of the top row
                CALL    FIND_NEXT       ;And find the next line
                MOV     TOP_OF_SCREEN,BX;Store the new top of screen
                JMP     SHIFT_RET
DOWN            ENDP

;-----------------------------------------------------------------
; These two routines move the screen one page at a time by calling the
; UP and DOWN procedures.
;-----------------------------------------------------------------
PGDN            PROC    NEAR
                MOV     PAGE_PROC,OFFSET DOWN
PAGE_UP_DN:
                MOV     CL,ROWS         ;Get length of the screen
                DUE     CL,5            ;Don't page a full screen
                XOR     CH,CH           ;Make it a word
PAGE_LOOP:
                PUSH    CX
                CALL    PAGE_PROC       ;Move the cursor down
                POP     CX
                LOOP    PAGE_LOOP       ;Loop for one page length
                RET
PGDN            ENDP

PGUP            PROC    NEAR
                MOV     PAGE_PROC,OFFSET UP
                JMP     PAGE_UP_DN
PGUP            ENDP

;-----------------------------------------------------------------
; This toggles the insert/overstrike mode.
;-----------------------------------------------------------------
INSERT          PROC    NEAR
                NOT     INSERT_MODE     ;Toggle the switch
                JMP     REDO_PROMPT     ;Redraw the insert status
INSERT          ENDP

;-----------------------------------------------------------------
; This deletes the character at the cursor by shifting the remaining
; characters forward.
;-----------------------------------------------------------------
DEL_CHAR        PROC    NEAR
                MOV     CX,LAST_CHAR
                MOV     BX,CURSOR
                MOV     DI,BX
                CMP     BX,CX           ;Are we at end of file?
                JAE     NO_DEL          ;If yes, then don't delete
                LODSB
                CALL    SAVE_CHAR       ;Save it for UNDO function
                MOV     AX,[BX]         ;Look at the next character also
                PUSH    AX              ;Save character were deleting
                DEC     LAST_CHAR       ;Shorten the file by one
                SUB     CX,BX
                REP     MOVSB           ;Move file down one notch

                POP     AX              ;Get back character we deleted
                CMP     AL,CR           ;Did we delete a CR?
                JE      COMBINE
                OR      DIRTY_BITS,4    ;Current line is dirty
NO_DEL:
                RET
COMBINE:
                CMP     AX,LF           ;Was the next character a LF?
                JNE     NO_DEL_LF
                CALL    DEL_CHAR        ;Now delete the line feed
NO_DEL_LF:
                CALL    DISPLAY_BOTTOM  ;Repaint bottom of the screen
                MOV     DX,CUR_POSN
                MOV     SAVE_COLUMN,DL  ;Save the cursor column
                RET
DEL_CHAR        ENDP

;-----------------------------------------------------------------
; This toggles the mark STATE and resets the paste buffer pointers.
;-----------------------------------------------------------------
MARK            PROC    NEAR
                XOR     AX,AX
                NOT     MARK_MODE       ;Toggle the mode flag
                CMP     MARK_MODE,AL    ;Turning mode ON?
                JNE     MARK_OK
                MOV     DIRTY_BITS,1    ;Need to redraw the screen
                MOV     MARK_START,0FFFFH
                JMP     SHORT MARK_RET
MARK_ON:
                MOV     AX,CURSOR       ;Get the cursor offset
                MOV     MARK_START,AX   ;Start of marked range
MARK_RET:
                MOV     MARK_END,  AX   ;End of marked range
                MOV     MARK_HOME, AX   ;Center of marked range
                RET
MARK            ENDP

;-----------------------------------------------------------------
; This removes the marked text and places it in the PASTE BUFFER
;-----------------------------------------------------------------
CUT             PROC    NEAR
```

(TED.ASM continues)



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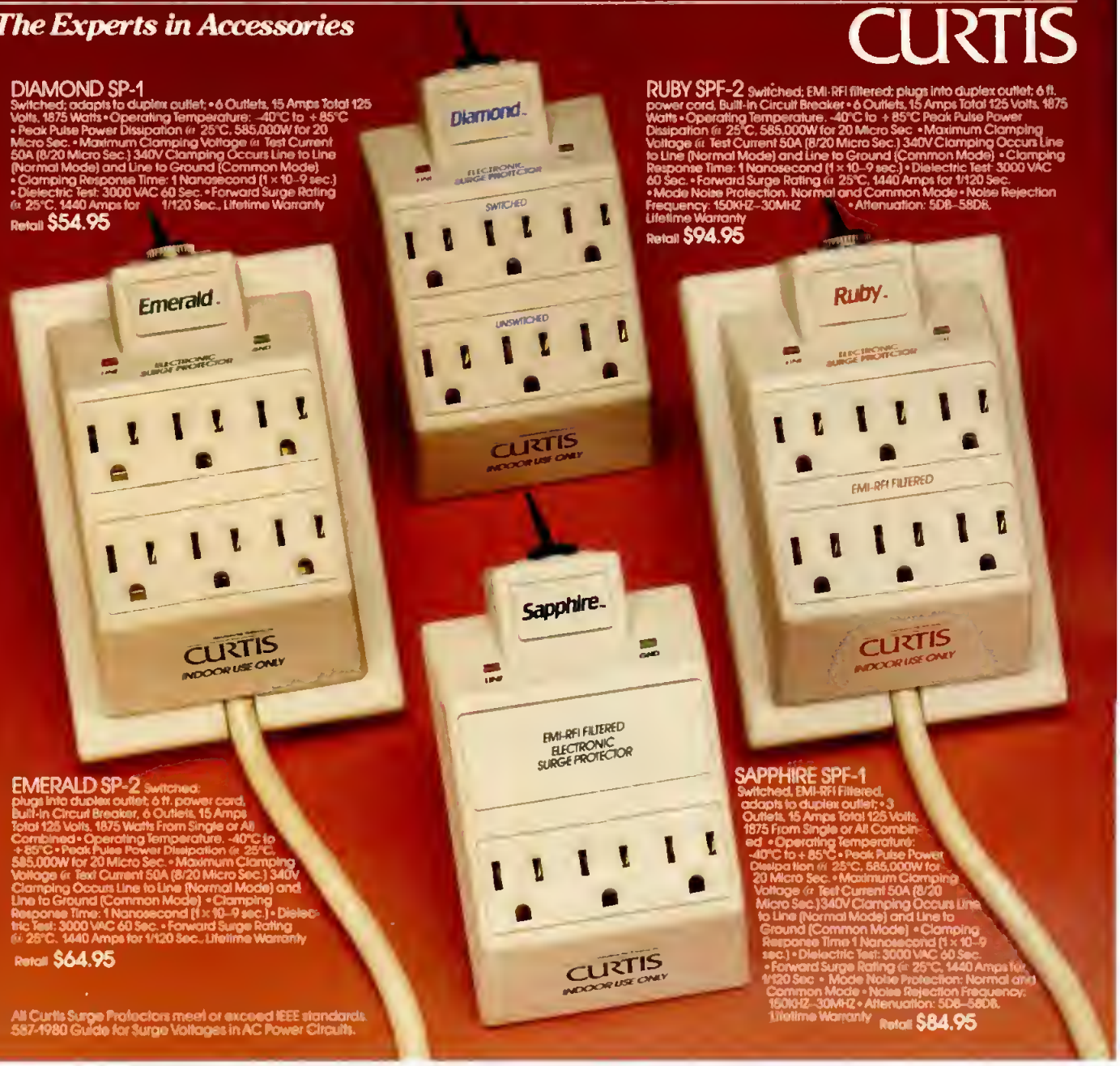
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C-1 CIRCLE 486 ON READER SERVICE CARD

PC MAGAZINE

HELP FILE

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I/O (Input Output) Statements

PRINT # — Write data sequentially to a file
SYNTAX: PRINT #*filenum*, *list* [;]
(Same comments as in LPRINT)

PRINT # USING — Write formatted data sequentially to a file
SYNTAX: PRINT #*filenum* USING *formatstring*; *list* [;]
formatstring — (see LPRINT USING)

PUT — Write record from buffer to random file
SYNTAX: PUT [#] *filenum* [,*number*]
number — record number to write, 1 to 16 million. Default record after last PUT.

RSET — Move data into file buffer (right justified)
SYNTAX: RSET *stringvar* = *string*
stringvar — usually a variable defined in a FIELD statement

WIDTH — Set output line width
SYNTAX: WIDTH *size* —or— WIDTH *device*, *size*
—or— WIDTH #*filenum*, *size*
size — width after which BASIC inserts a carriage return (0..255). 255 disables.
device — SCRN:, LPT1:, LPT2:, LPT3:, COM1:, COM2:

WRITE —Write data to screen
SYNTAX: WRITE [*list*]
NOTE: WRITE differs from PRINT in that it inserts commas between items, delimits strings with quotation marks, and does not insert a space before positive numbers. BASIC edds a carriage return/line feed efter the last item.

WRITE # —Write data to sequential file
SYNTAX: WRITE #*filenum* [*list*]
(See NOTE re WRITE)

Graphics and Screen Statements

CIRCLE — Draw an ellipse on the screen
SYNTAX: CIRCLE (*x*,*y*),*r* [,*color* [,*start*, *end* [,*aspect*]]]
(*x*,*y*) — coordinates of the center of the ellipse
r — radius (major) of the ellipse
color — color attribute for the ellipse
start,*end* — starting end ending angles to draw just an arc
aspect — ratio of *x*-axis to *y*-axis

CLS — Clear the screen in current color
SYNTAX: CLS

COLOR —Set colors in text mode
SYNTAX: COLOR [*foreground*] [,[*background*] [,*border*]]
foreground — 0..31
background — 0..7
border — 0..15
NOTE: You can omit eny parameter, in which case the corresponding color will not change. Colors between 16 and 31 produce a flashing effect.

COLOR — Set colors in graphics mode
SYNTAX: COLOR [*background*] [,[*palette*]]
background — 0..15
palette — 0 or 1. 0 (or any even number) selects green/red/brown palette, 1 (or any odd number) selects cyan/magenta/white.
NOTE: You can omit any parameter, in which case the corresponding color will not change.

DRAW — Interpret a string of graphics DRAW commands
SYNTAX: DRAW *string*
NOTE: DRAW interprets the string argument es e line of graphics definition language. The language consists of the following commands.
(In the movement commands, *n* represents the distance to move in units set by the scaling factor command S.)

U *n*	Move up
D *n*	Move down
L *n*	Move left
R *n*	Move right
E *n*	Move up and right
F *n*	Move down and right
G *n*	Move down and left
H *n*	Move up and left
M *x*,*y*	Move absolute or relative. If *x* or *y* has a plus or minus sign, move relative to current point; otherwise move directly to point (*x*,*y*). Only relative M is affected by scaling factor.
B	Prefixed to any of above commands, means move but don't plot points
N	Prefixed to any of above commands, means move but return to original position when through
A *n*	Set angle *n*, 0 to 3. 0 = 0 degrees, 1 = 90 degrees, 2 = 180 degrees, 3 = 270 degrees.
TA *n*	Turn angle *n*, -360..+360 degrees. Minus is clockwise turn; plus is counterclockwise.
C *n*	Set color *n* (0 to 3 in medium resolution, 0 to 1 in high resolution)
S *n*	Set scale factor from 1 to 255. Actual scale factor is S/4; default S is 4.

X *string*; Execute substring. Allows a DRAW string to execute a second string.
P *paint*, *boundary* Fill area bounded by *boundary* color with *paint* color.

NOTE: All the *n*,*x*, and *y* arguments can be replaced by numeric variables by putting an equals sign before the variable name and a semicolon efter. In compiled BASIC you must use the VARPTR$(*variable*) form for any variables.

GET — Read points from an area of the screen
SYNTAX: GET (*x1*,*y1*)—(*x2*,*y2*), *array*
(*x1*,*y1*)—(*x2*,*y2*) — coordinates of rectangular area to get
array — array to hold the information you get

—Neil J. Rubenking

This is the third in e series of Help Files about BASIC Statements

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```
                CMP     MARK_MODE,0     ;Is the mark mode on?
                JE      NO_MARK         ;If not, then do nothing
                MOV     CX,MARK_END     ;Get end of mark region
                MOV     SI,MARK_START   ;Get start of mark region
                SUB     CX,SI           ;Number of bytes selected
                MOV     PASTE_SIZE,CX
                JCXZ    NO_MARK
                XOR     DI,DI           ;Point to paste buffer

                PUSH    CX
                PUSH    ES
                MOV     ES,PASTE_SEG    ;Get the paste segment
                REP     MOVSB           ;Put deleted text in buffer
                POP     ES
                POP     AX

                MOV     CX,LAST_CHAR
                SUB     LAST_CHAR,AX    ;Shorten the file this much
                MOV     DI,MARK_START
                MOV     SI,MARK_END
                SUB     CX,SI
                JCXZ    NO_DELETE
                REP     MOVSB           ;Shorten the file
NO_DELETE:
                MOV     DX,CUR_POSN
                MOV     SI,MARK_START
                CALL    LOCATE          ;Adjust the screen position
                CALL    MARK            ;This turns off select
NO_MARK:
                RET
CUT             ENDP

;---------------------------------------------------------------------
; This copies the paste buffer into the file at the cursor location
;---------------------------------------------------------------------
PASTE           PROC    NEAR
                MOV     AX,PASTE_SIZE   ;Number of characters in buffer
                OR      AX,AX           ;Any there?
                JZ      NO_PASTE        ;If not, nothing to paste
                MOV     SI,CURSOR       ;Get cursor location
                PUSH    AX
                PUSH    SI
                CALL    OPEN_SPACE      ;Make room for new characters
                POP     DI
                POP     CX
                JC      NO_PASTE        ;If no room, just exit
                XOR     SI,SI           ;Point to paste buffer
                PUSH    DS
                MOV     DS,PASTE_SEG    ;Segment of paste buffer
                REP     MOVSB           ;Copy in the new characters
                POP     DS
                MOV     SI,DI
                MOV     CURSOR,SI       ;Cursor moved to end of insert
                MOV     DX,CUR_POSN     ;Get current cursor row
                CALL    LOCATE          ;Adjust the screen position
                MOV     DIRTY_BITS,1    ;Redraw the screen
NO_PASTE:
                RET
PASTE           ENDP

;---------------------------------------------------------------------
; This prints the marked text.  If printer fails, it is canceled.
;---------------------------------------------------------------------
PRINT           PROC    NEAR
                CMP     MARK_MODE,0     ;Is mark mode on?
                JE      PRINT_RET       ;If not, nothing to print
                MOV     CX,MARK_END     ;End of marked region
                MOV     SI,MARK_START   ;Start of marked region
                SUB     CX,SI           ;Number of bytes selected
                JCXZ    PRINT_DONE      ;If nothing to print, return

                MOV     AX,2
                XOR     DX,DX           ;Select printer 0
                INT     17H             ;Get printer status
                TEST    AH,10000000B    ;Is busy bit set?
                JZ      PRINT_DONE
                TEST    AH,00100000B    ;Is printer out of paper?
                JNZ     PRINT_DONE
PRINT_LOOP:
                LODSB
                XOR     AX,AX
                INT     17H             ;Print the character
                ROR     AX,1            ;Check time out bit
                JC      PRINT_DONE      ;If set, quit printing
                LOOP    PRINT_LOOP
                MOV     AL,CR
                XOR     AX,0
                INT     17H             ;Finish with a CR
PRINT_DONE:
                CALL    MARK            ;Turn off the mark status
PRINT_RET:
                RET
PRINT           ENDP

;---------------------------------------------------------------------
; This command restores any characters which have recently been deleted.
;---------------------------------------------------------------------
UNDO            PROC    NEAR
                XOR     AX,AX
                XCHG    AX,UNDO_LENGTH  ;Get buffer length
                MOV     SI,OFFSET UNDO_BUFFER
                JMP     INSERT_STRING
UNDO            ENDP

;---------------------------------------------------------------------
; This inserts AX characters from CS:SI into the file.
;---------------------------------------------------------------------
INSERT_STRING   PROC    NEAR
                PUSH    SI              ;Save string buffer
                MOV     SI,CURSOR       ;Get cursor offset
                PUSH    AX              ;Save length of string
                PUSH    SI
                CALL    OPEN_SPACE      ;Make space to insert string
                POP     DI              ;Get back cursor position
                POP     CX              ;Get back string length
                POP     SI              ;Get back string buffer
                JC      NO_SPACE        ;If no space available, exit

                PUSH    DS
                PUSH    CS
                POP     DS
                ASSUME  DS:CSEG
                REP     MOVSB           ;Copy the characters in
                MOV     SI,CURSOR       ;Get the new cursor offset
                MOV     DH,CUR_POSN     ;Also get the current row
                MOV     DIRTY_BITS,1    ;And redraw the screen
                POP     DS
                ASSUME  DS:NOTHING
                CALL    LOCATE          ;Adjust the screen position
NO_SPACE:
                RET
INSERT_STRING   ENDP

;---------------------------------------------------------------------
; This adds a character to the undo buffer.
;---------------------------------------------------------------------
SAVE_CHAR       PROC    NEAR
                MOV     SS,UNDO_LENGTH
                OR      SS,SS           ;Is buffer filled?
                JNE     NO_SAVE
                INC     UNDO_LENGTH
                MOV     BYTE PTR CS:UNDO_BUFFER[SS],AL
NO_SAVE:
                RET
SAVE_CHAR       ENDP

;---------------------------------------------------------------------
; This prompts for a verify keystroke then exits without saving the file
;---------------------------------------------------------------------
ABORT           PROC    NEAR
                ASSUME  DS:CSEG
                PUSH    CS
                POP     DS
                MOV     DH,ROWS         ;Last row on display
                DEC     DH              ;Bottom row of screen
                XOR     DL,DL           ;First column
                MOV     SI,OFFSET VERIFY_MESS
                CALL    TTY_STRING      ;Display verify message

                XOR     AX,AX           ;Read the next key
                INT     16H             ;BIOS read key routine
                OR      AL,32           ;Convert to lower case
                CMP     AL,"y"          ;Was answer Yes?
                JE      FINISHED        ;If yes, then were finished
                CALL    REDO_PROMPT     ;If not, redraw the prompt
                PUSH    ES
                POP     DS              ;Set DS back to file segment
                RET
FINISHED:
                MOV     DH,ROWS         ;Move to last row on screen
                XOR     DL,DL           ;And column zero
                CALL    SET_CURSOR
                INC     DH
                CALL    ERASE_EOL       ;Erase the last row
EXIT_TO_DOS:
                PUSH    CS
                POP     DS              ;Point to code segment
                MOV     DX,OFFSET COPYRIGHT
                MOV     AH,9            ;Display string
                INT     21H
                MOV     AX,4C00H
                INT     21H

ABORT           ENDP

;---------------------------------------------------------------------
; This prompts for a filename then writes the file.  The original file
; is renamed to filename.BAK.  If an invalid filename is entered, the
; speaker is beeped.
;---------------------------------------------------------------------
EXIT            PROC    NEAR

                PUSH    DS
                PUSH    ES
                MOV     AX,CS
                MOV     DS,AX
                MOV     ES,AX
                ASSUME  DS:CSEG, ES:CSEG
NEXT_LETTER:
                MOV     DH,ROWS
                DEC     DH              ;Last row on the screen
                XOR     DL,DL           ;First column
                MOV     SI,OFFSET SAVE_MESS
                PUSH    DI
                CALL    TTY_STRING      ;Display a prompt
                POP     DI
                ADD     DL,9            ;Move right 9 spaces
                MOV     SI,NAME_POINTER
                CALL    TTY_STRING      ;Display the filename

                XOR     AH,AX           ;Read the next key
                INT     16H
```

(TED.ASM continues)

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```
                MOV     DI,NAME_END     ;This points to last letter
                OR      AL,AL           ;Is it a real character?
                JZ      NEXT_LETTER     ;Ignore special keys
                CMP     AL,27           ;Is it escape?
                JNE     NOT_ESCAPE

                MOV     DIRTY_BITS,1    ;Redraw the screen
                POP     ES              ;Get back file segments
                POP     DX
                JMP     REDO_PSOMPT     ;Redraw the prompt
NOT_ESCAPE:
                CMP     AL,13           ;Is it CR?
                JE      GOT_NAME
                CMP     AL,8            ;Is it a backspace?
                JNE     NORMAL_LETTER
                CMP     DI,NAME_POINTER ;At first letter?
                JLE     NEXT_LETTER     ;If yes, dont erase it
                MOV     BYTE PTR [DI-1],0
                DEC     NAME_END
                JMP     NEXT_LETTER
NORMAL_LETTER:
                CMP     DI,81H + 45     ;Too many letters?
                JG      NEXT_LETTER     ;If yes, ignore them
                XOR     AX,AX
                STOSW                   ;Store the new letter
                LOOP    NAME_END        ;Name is one character longer
                JMP     SENT_LETTER     ;Read another keystroke
GOT_NAME:
                MOV     DX,NAME_POINTER ;Point to the filename
                MOV     AX,4300H        ;Get the files attribute
                INT     21H
                JNC     NAME_OK         ;If no error, filename is OK
                CMP     AX,3            ;Was it path not found error?
                JE      BAD_NAME        ;If yes, filename was bad
NAME_OK:
                MOV     SI,OFFSET DOT_$$$       ;Point to the ".$$$"
                MOV     DI,OFFSET NAME_DOT_$$$
                CALL    CHG_EXTENSION           ;Add the new extension

                MOV     DX,OFFSET NAME_DOT_$$$  ;Point to the temp filename
                MOV     AX,3CH                  ;Function to create file
                MOV     CX,2H                   ;Attribute for new file
                INT     21H                     ;Try to create the file
                JNC     NAME_WAS_OK             ;Continue if name was OK
BAD_NAME:
                MOV     AX,0E07H        ;Write a bell character
                INT     10H             ;BIOS tty service
                JMP     SENT_LETTER     ;Get another letter
WRITE_ERROR:
                MOV     AX,3E0          ;Close the file
                INT     21H
                JMP     BAD_NAME        ;Filename must be bad
NAME_WAS_OK:
                XOR     DX,DX           ;This is the file buffer
                MOV     CX,LAST_CHAR    ;Number of chars in file
                MOV     DI,CX
                MOV     BX,AX           ;This is the handle
                MOV     AX,400          ;Write to the file
                POP     DS              ;Recover buffer segment
                CMP     CX,0FFFFH       ;Is buffer already full?
                JE      DONT_ADD_EOF    ;If yes, dont add EOF mark
                INC     CX              ;Plus one character for EOF mark
                MOV     BYTE PTR [DI],1AH;Add the EOF marker
DONT_ADD_EOF:
                INT     21H             ;Write the buffer contents
                POP     DS
                JC      WRITE_ERROR     ;Exit on a write error
                CMP     AX,CX           ;Was entire file written?
                JNE     WRITE_ERROR     ;If not, exit

                PUSH    CS
                POP     DS              ;Get the code segment
                MOV     AX,3EH
                INT     21H                     ;Close the temp file
                MOV     SI,OFFSET DOT_BAK       ;Point to the ".BAK"
                MOV     DI,OFFSET NAME_DOT_BAK
                CALL    CHG_EXTENSION           ;Make the backup filename

                MOV     DX,OFFSET NAME_DOT_BAK  ;Point to the backup name
                MOV     AH,41H
                INT     21H                     ;Delete existing backup file
                MOV     DI,OFFSET NAME_DOT_BAK
                MOV     DX,NAME_POINTER
                MOV     AX,56H
                INT     21H

                MOV     DI,NAME_POINTER ;Point to new filename
                MOV     DX,OFFSET NAME_DOT_$$$ ;Point to temporary file
                MOV     AH,56H          ;Rename temp to new file
                INT     21H             ;DOS function to rename
                POP     AX              ;Restore the stack
                POP     AX
                JMP     FINISHED
EXIT            ENDP
;---------------------------------------------------------------------
; This subroution displays a character by writing directly
; to the screen buffer.  To avoid screen noise (snow) on the color
; card, the horizontal retrace has to be monitored.
;---------------------------------------------------------------------
WRITE_INVERSE   PROC    NEAR
                ASSUME  DS:FILE_SEG, ES:FILE_SEG
                MOV     BX,INVERSE      ;Attribute for inverse video
                JMP     SHORT WRITE_SCREEN
WRITE_NORMAL:
                MOV     BX,NORMAL       ;Attribute for normal video
WRITE_SCREEN:
                MOV     BL,AL           ;Save the character
                PUSH    ES
                MOV     DX,STATUS_REG   ;Retrieve status register
                MOV     ES,VIDEO_SEG    ;Get segment of video buffer
HWAIT:
                IN      AL,DX           ;Get video status
                SHR     AL,1            ;Look at horisontal retrace
                JNC     HWAIT           ;Wait for retrace
WRITE_IT:
                MOV     AX,BX           ;Get the character/attribute
                STOSW                   ;Write the character
                POP     ES
                RET
WRITE_INVERSE   ENDP

;---------------------------------------------------------------------
; This moves the cursor to the row/column in DX.
;---------------------------------------------------------------------
SET_CURSOR      PROC    NEAR
                XOR     BX,BX           ;Were using page zero
                MOV     AX,2            ;BIOS set cursor function
                INT     10H
                RET
SET_CURSOR      ENDP

;---------------------------------------------------------------------
; This computes the video buffer offset for the row/column in DX
;---------------------------------------------------------------------
POSITION        PROC    NEAR
                MOV     AX,COLUMNS      ;Take columns per row
                MUL     DX              ;Times row number
                XOR     DX,DX
                ADD     AX,DX           ;Add in the column number
                SHL     AX,1            ;Times 2 for offset
                MOV     DI,AX           ;Return result in DI
                RET
POSITION        ENDP

;---------------------------------------------------------------------
; This erases from the location in DX to the right edge of the screen
;---------------------------------------------------------------------
ERASE_EOL       PROC    NEAR
                CALL    POSITION        ;Find screen offset
                MOV     CX,COLUMNS      ;Get screen size
                SUB     CL,DL           ;Subtract current position
                JCXZ    NO_CLEAR
ERASE_LOOP:
                MOV     AL," "          ;Write blanks to erase
                CALL    WRITE_NORMAL    ;Display it
                LOOP    ERASE_LOOP
NO_CLEAR:       RET
ERASE_EOL       ENDP

;---------------------------------------------------------------------
; This displays the function key prompt and insert mode state
;---------------------------------------------------------------------
REDO_PROMPT     PROC    NEAR
                ASSUME  DS:NOTHING, ES:NOTHING
                PUSH    DS
                PUSH    CS
                POP     DS
                ASSUME  DS:CSEG
                MOV     DS,ROWS         ;Put prompt at last row
                DEC     DX
                XOR     DL,DL           ;And column 0
                CALL    POSITION        ;Convert to screen offset
                MOV     SI,OFFSET PROMPT_STRING
KEY_LOOP:
                MOV     AL,"F"          ;Display an "F"
                CALL    WRITE_NORMAL
                LODSB
                OR      AL,AL           ;Last key in prompt?
                JZ      PROMPT_DONE
                CALL    WRITE_NORMAL

                CMP     BYTE PTR CS:[SI],"0"    ;Is it F10?
                JNE     TEXT_LOOP
                LODSB
                CALL    WRITE_NORMAL
TEXT_LOOP:
                LODSB
                OR      AL,AL           ;Last letter in word?
                JNZ     WRITE_CHAR

                MOV     AL," "          ;Display a space
                CALL    WRITE_NORMAL
                JMP     KEY_LOOP
WRITE_CHAR:
                CALL    WRITE_INVERSE   ;Display the letter
                JMP     TEXT_LOOP       ;Do the next letter
PROMPT_DONE:
                MOV     DH,ROWS
                INC     DH              ;Get to last row on screen
                MOV     DL,PROMPT_LENGTH + 9
                CALL    ERASE_EOL       ;Erase to the end of this row
                MOV     AL,"O"          ;Write an "O"
                CMP     INSERT_MODE,0   ;In insert mode?
                JE      OVERSTRIKE
                MOV     AL,"I"          ;Write an "I"
OVERSTRIKE:
                DEC     DI              ;Backup one character position
                DEC     DI
                CALL    WRITE_NORMAL
                POP     DS
                RET
REDO_PSOMPT     ENDP
```

(TED.ASM continues)



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CIRCLE 263 ON READER SERVICE CARD

■ UTILITIES

```
;---------------------------------------------------------------------
; This displays the file buffer on the screen.
;---------------------------------------------------------------------
DISPLAY_SCREEN  PROC    NEAR
                ASSUME  DS:FILE_SEG, ES:FILE_SEG
                MOV     SI,TOP_OF_SCREEN;Point to first char on screen
                XOR     DH,DH           ;Start at first row
                JMP     SHORT NEXT_ROW
DISPLAY_BOTTOM:                         ;This redraws the bottom only
                CALL    FIND_START      ;Find first character on this row
                MOV     DX,CUR_POSN     ;Get current cursor row
NEXT_ROW:
                PUSH    DX
                CALL    DISPLAY_LINE    ;Display a line
                POP     DX
                INC     DH              ;Move to the next row
                CMP     DH,SCRN_SIZE    ;At end of screen yet?
                JNE     NEXT_ROW        ;Do all the rows
                RET
DISPLAY_SCREEN  ENDP

;---------------------------------------------------------------------
; This subroutine displays a single line to the screen. DH holds the
; row number, SI has the offset into the file buffer. Tabs are expanded.
; Adjustment is made for side shift.
;---------------------------------------------------------------------
DISPLAY_CURRENT PROC    NEAR
                CALL    FIND_START
                MOV     DX,CUR_POSN
DISPLAY_LINE:
                XOR     DL,DL           ;Start at column zero
                MOV     MARGIN_COUNT,DL
                MOV     CX,DX           ;Use CL to count the columns
                CALL    POSITION        ;Compute offset into video
NEXT_CHAR:
                CMP     SI,LAST_CHAR    ;At end of file?
                JAE     LINE_DONE
                LODSB                   ;Get next character
                CMP     AL,CR           ;Is it a carriage return?
                JE      FOUND_CR        ;Quit when a CR is found
                CMP     AL,TAB          ;Is this a Tab character
                JE      EXPAND_TAB      ;If yes, expand to spaces
                CALL    PUT_CHAR        ;Put character onto screen
TAB_DONE:
                CMP     CL,COLUMNS      ;At right edge of screen?
                JB      NEXT_CHAR
                CMP     BYTE PTR [SI],CR;Is this the end of the line?
                JE      NOT_BEYOUND
                DEC     DI              ;Backup one character
                DEC     DI
                MOV     AL,4            ;Show a diamond
                CALL    WRITE_INVERSE   ;In inverse video
NOT_BEYOUND:
                JMP     FIND_NEXT       ;Find start of next line
FOUND_CR:
                LODSB                   ;Look at the next character
                CMP     AL,LF           ;Is it a line feed?
                JE      LINE_DONE
                DEC     SI
LINE_DONE:
                MOV     DX,CX
                JMP     ERASE_EOL       ;Erase the rest of the line
EXPAND_TAB:
                MOV     AL,' '          ;Convert Tabs to spaces
                CALL    PUT_CHAR
                MOV     AL,MARGIN_COUNT
                ADD     AL,CL
                TEST    AL,00000111b    ;At even multiple of eight?
                JNZ     EXPAND_TAB      ;If not keep adding spaces
                JMP     TAB_DONE
DISPLAY_CURRENT ENDP

;---------------------------------------------------------------------
; This displays a single character to the screen.  If the character is
; marked, it is shown in inverse video.  Characters outside the current
; margin are not displayed. Characters left of the margin are skipped.
;---------------------------------------------------------------------
PUT_CHAR        PROC    NEAR
                MOV     BL,MARGIN_COUNT ;Get distance to left margin
                CMP     BL,LEFT_MARGIN  ;Are we inside left margin?
                JAE     IN_WINDOW       ;If yes, show the character
                INC     BL
                MOV     MARGIN_COUNT,BL
                RET
IN_WINDOW:
                CMP     SI,MARK_START   ;Is this character marked?
                JBE     NOT_MARKED
                CMP     SI,MARK_END
                JA      NOT_MARKED
                CALL    WRITE_ISVERSE   ;Marked characters shown inverse
                JMP     SHORT SENT_COL
NOT_MARKED:
                CALL    WRITE_NORMAL
SENT_COL:
                INC     CL              ;Increment the column count
                RET
PUT_CHAR        ENDP

;---------------------------------------------------------------------
; This routine adds a character into the file.  In insert mode, remaining
; characters are pushed forward. If a CR is inserted, a LF is added also.
;---------------------------------------------------------------------
INSERT_KEY      PROC    NEAR
                MOV     SI,CURSOR
                CMP     AL,CR           ;Was this a carriage return
                JE      NEW_LINE

                MOV     SI,CURSOR
                CMP     INSERT_MODE,0   ;In insert mode?
                JNE     ISSERT_CHAR
                CMP     BYTE PTR [SI],CR;At end of line?
                JE      ISSERT_CHAR
                CMP     SI,LAST_CHAR    ;At end of file?
                JE      ISSERT_CHAR
                MOV     DI,SI
                XCHG    DS:[SI],AL      ;Switch new character for old one
                CALL    SAVE_CHAR       ;Store the old character
                JMP     SHORT ADVANCE
ISSERT_CHAR:
                PUSH    SI
                PUSH    AX              ;Save the new character
                MOV     AX,1
                CALL    OPEN_SPACE      ;Make room for it
                POP     AX              ;Get back the new character
                POP     DI
                JC      FILE_FULL
                STOSB                   ;Insert character in file buffer
ADVANCE:
                OR      DIRTY_BITS,4    ;Current line is dirty
                PUSH    UNDO_LENGTH
                CALL    SIGHT           ;Move cursor to next letter
                POP     UNDO_LENGTH
FILE_FULL:
                RET
NEW_LINE:
                PUSH    SI
                MOV     AX,2
                CALL    OPEN_SPACE      ;Make space for CR and LF
                POP     DI              ;Get back old cursor location
                JC      FILE_FULL
                MOV     AX,LF*256+CR
                STOSW                   ;Store the CR and LF
                CALL    DISPLAY_BOTTOM  ;Repaint bottom of the screen
                CALL    SOME            ;Cursor to start of line
                JMP     DOWN            ;Move down to the new line
INSERT_KEY      ENDP

;---------------------------------------------------------------------
; This subroutine inserts spaces into the file buffer.  On entry AX
; contains the number of spaces to be inserted.  On return, CF=1 if
; there was not enough space in the file buffer.
;---------------------------------------------------------------------
OPEN_SPACE      PROC    NEAR
                MOV     CX,LAST_CHAR    ;Last character in the file
                MOV     SI,CX
                MOV     DI,CX
                ADD     DI,AX           ;Offset for new end of file
                JC      NO_ROOM         ;If no more room, return error
                MOV     LAST_CHAR,DI    ;Save offset of end of file
                SUB     CX,CURSOR       ;Number of characters to shift
                DEC     DI
                DEC     SI
                STD                     ;String moves goes forward
                REP     MOVSB           ;Shift the file upward
                CLD
                CLC
NO_ROOM:
                RET
OPEN_SPACE      ENDP

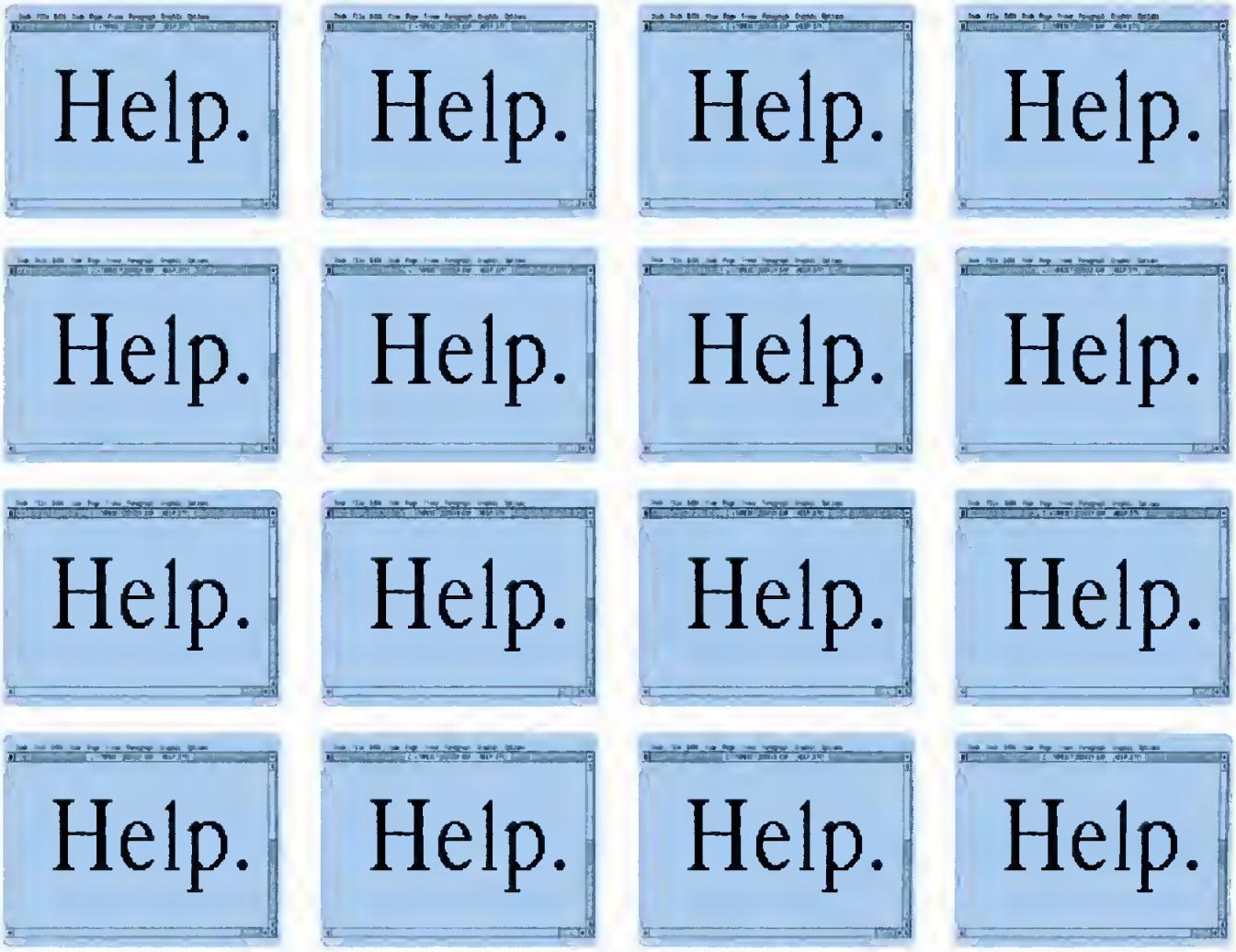
;---------------------------------------------------------------------
; This subroutine adjusts the cursor position ahead to the saved cursor
; column.  On entry DH has the cursor row.
;---------------------------------------------------------------------
SHIFT_RIGHT     PROC    NEAR
                MOV     CL,SAVE_COLUMN  ;Keep the saved cursor offset
                XOR     CH,CH
                MOV     BP,CX           ;Keep the saved cursor position
                ADD     CL,LEFT_MARGIN  ;Shift into visable window also
                ADC     CH,0
                XOR     DL,DL
                MOV     CUR_POSN,DX     ;Get cursor row/column
                JCXZ    NO_CHANGE
RIGHT_AGAIN:
                PUSH    CX
                CMP     BYTE PTR [SI],CR;At end of line?
                JE      DONT_MOVE       ;If at end, stop moving
                CALL    RIGHT           ;Move right one character
DONT_MOVE:
                POP     CX

                MOV     AL,SAVE_COLUMN
                XOR     AH,AH
                CMP     AX,CX           ;Is cursor still in margin?
                JL      IN_MARGIN       ;If yes, keep moving

                MOV     DX,CUR_POSN     ;Get cursor column again
                XOR     DS,DS
                CMP     DX,SP           ;At saved cursor position?
                JE      SIGHT_DONE      ;If yes, were done
                JA      RIGHT_TOO_FAR   ;Did we go too far?
IN_MARGIN:
                LOOP    RIGHT_AGAIN
SIGHT_DONE:
                MOV     CX,SP
                MOV     SAVE_COLUMN,CL  ;Get back saved cursor position
NO_CHANGE:
                RET
RIGHT_TOO_FAR:
                CALL    LEFT            ;Move back left one place
                MOV     CX,BP
                MOV     SAVE_COLUMN,CL  ;Get back saved cursor position
                RET
SHIFT_RIGHT     ENDP
```

(TED.ASM continues)

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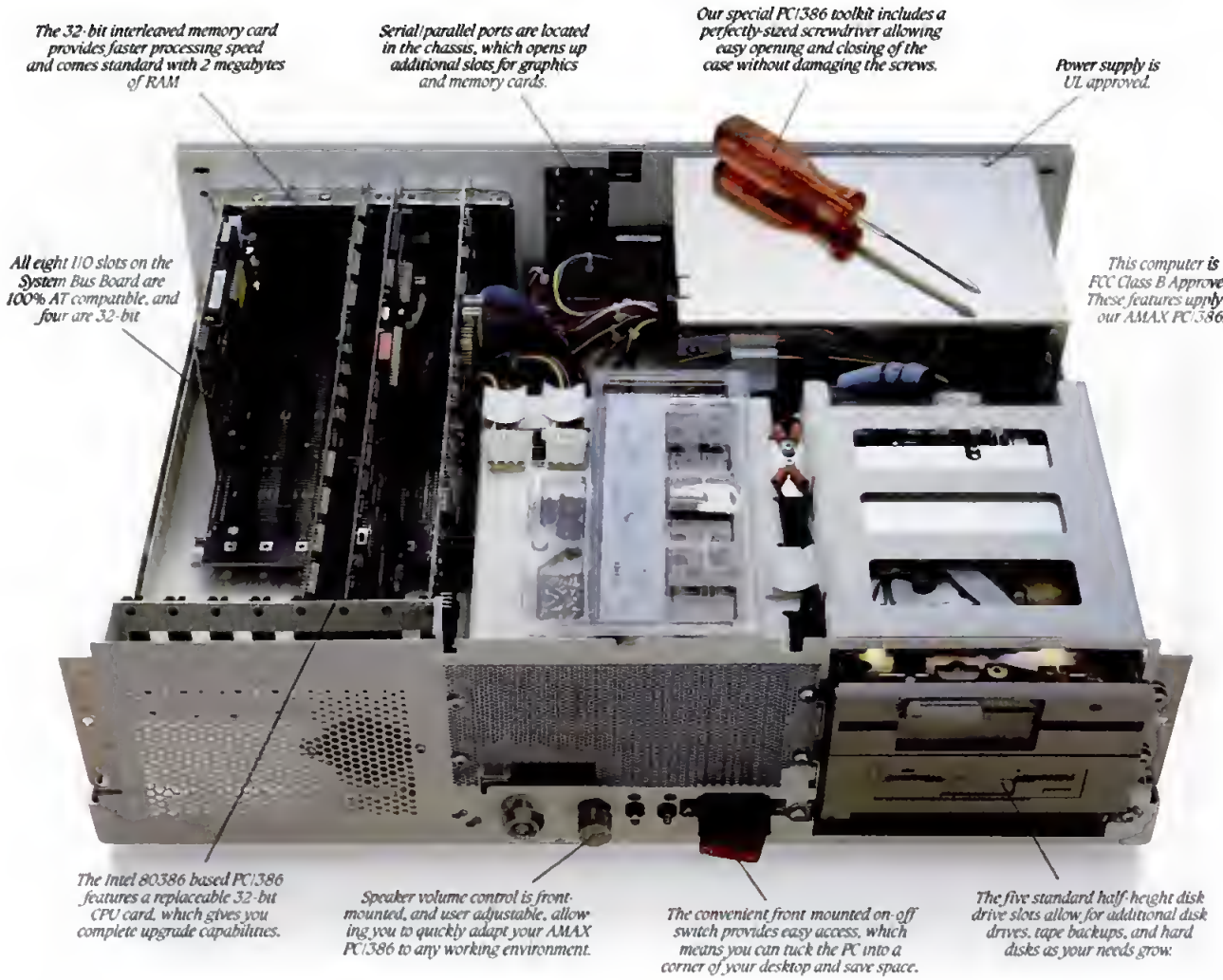
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■ UTILITIES

```
;-----------------------------------------------------------------
; This subroutine skips past the CR and LF at SI.  SI returns new offset
;-----------------------------------------------------------------
SKIP_CR_LF      PROC    NEAR
                CMP     SI,LAST_CHAR    ;At last char in the file?
                JAE     NO_SKIP         ;If yes, dont skip anything
                CMP     BYTE PTR [SI],CR;Is first character a CR?
                JNE     NO_SKIP
                INC     SI              ;Look at next character
                CMP     SI,LAST_CHAR    ;Is it at the end of file?
                JAE     NO_SKIP         ;If yes, dont skip anymore
                CMP     BYTE PTR [SI],LF;Is next character a line feed?
                JNE     NO_SKIP         ;Skip any line feeds also
                INC     SI
NO_SKIP:
                RET
SKIP_CR_LF      ENDP

;-----------------------------------------------------------------
; This subroutine finds the beginning of the previous line.
;-----------------------------------------------------------------
FIND_PREVIOUS   PROC    NEAR
                PUSH    CURSOR          ;Save the cursor location
                CALL    FIND_CR         ;Find start of this line
                MOV     CURSOR,SI       ;Save the new cursor
                CALL    FIND_START      ;Find the start of this line
                POP     CURSOR          ;Get back starting cursor
                RET
FIND_PREVIOUS   ENDP

;-----------------------------------------------------------------
; This searches for the previous carriage return.  Search starts at SI.
;-----------------------------------------------------------------
FIND_CR         PROC    NEAR
                PUSH    CX
                MOV     AL,CR           ;Look for a carriage return
                MOV     DI,SI
                MOV     CX,SI
                JCXZ    AT_BEGINNING
                DEC     DI
                STD                     ;Search backwards
                REPNE   SCASB           ;Scan for the character
                CLD                     ;Restore direction flag
                INC     DI
                MOV     SI,DI
AT_BEGINNING:
                POP     CX
                RET
FIND_CR         ENDP

;-----------------------------------------------------------------
; This subroutine computes the location of the start of current line.
; Returns SI pointing to the first character of the current line.
;-----------------------------------------------------------------
FIND_START      PROC    NEAR
                MOV     SI,CURSOR       ;Get the current cursor
                OR      SI,SI           ;At start of the file?
                JZ      AT_START        ;If yes, were done
                CALL    FIND_CR         ;Find the
                CALL    SKIP_CR_LF
AT_START:
                RET
FIND_START      ENDP

;-----------------------------------------------------------------
; This finds the offset of the start of the next line.  The search is
; started at location ES:SI.  On return CF=1 of no CR was found.
;-----------------------------------------------------------------
FIND_NEXT       PROC    NEAR
                PUSH    CX
                CALL    FIND_EOL        ;Find the end of this line
                JC      AT_NEXT         ;If at end of file, return
                CALL    SKIP_CR_LF      ;Skip past CR and LF
                CLC                     ;Indicate end of line found
AT_NEXT:
                POP     CX
                RET
FIND_NEXT       ENDP

;-----------------------------------------------------------------
; This searches for the next carriage return in the file.  The search
; starts at the offset in register SI.
;-----------------------------------------------------------------
FIND_EOL        PROC    NEAR
                MOV     AL,CR           ;Look for a carriage return
                MOV     CX,LAST_CHAR    ;Last letter in the file
                SUB     CX,SI           ;Count for the search
                MOV     DI,SI
                JCXZ    AT_END          ;If nothing to search, return
                REPNE   SCASB           ;Scan for the character
                MOV     SI,DI           ;Return the location of the CR
                JCXZ    AT_END          ;If not found, return
                DEC     SI
                CLC                     ;Indicate the CR was found
                RET
AT_END:
                STC                     ;Indicate CR was not found
                RET
FIND_EOL        ENDP

;-----------------------------------------------------------------
; This subroutine positions the screen with the cursor at the row
; selected in register DH.  On entry, SI holds the cursor offset.
;-----------------------------------------------------------------
LOCATE          PROC    NEAR
                MOV     CL,DH
                XOR     CH,CH
                MOV     CURSOR,SI
                XOR     DX,DX           ;Start at top of the screen
                OR      SI,SI           ;At start of buffer?
                JZ      LOCATE_FIRST

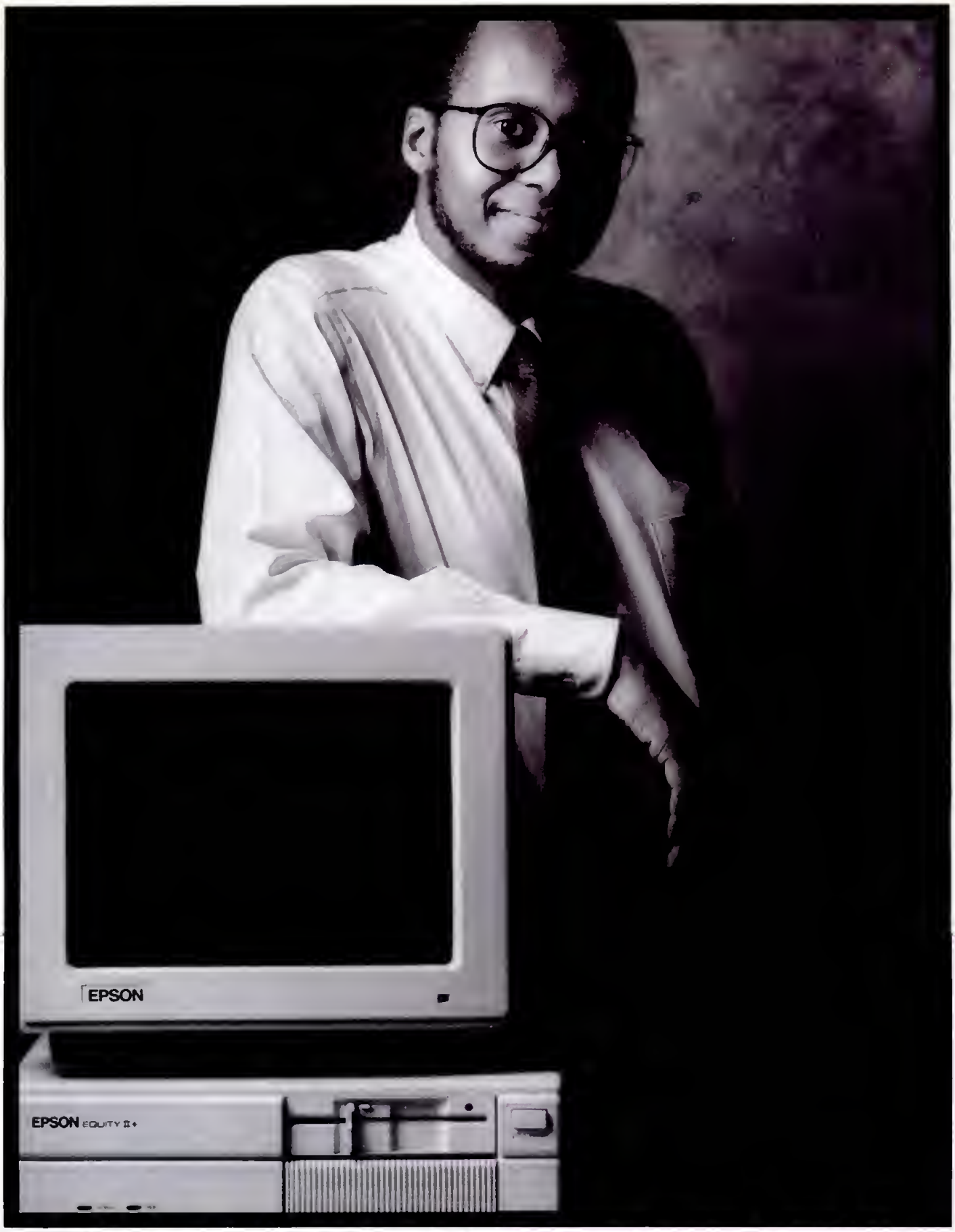
                CALL    FIND_START      ;Get start of this row
                XOR     DX,DX           ;Start at top of the screen
                OR      SI,SI           ;Is cursor at start of file?
                JZ      LOCATE_FIRST
                JCXZ    LOCATE_FIRST    ;If locating to top row were done
FIND_TOP:
                PUSH    SI
                PUSH    CX
                CALL    FIND_CR         ;Find previous row
                POP     CX
                POP     AX
                CMP     BYTE PTR [SI],CR
                JNE     LOCATE_FIRST
                CMP     SI,AX           ;Did it change?
                JE      LOCATE_DONE     ;If not, quit moving
                INC     DX              ;Cursor moves to next row
                LOOP    FIND_TOP
LOCATE_DONE:
                PUSH    CURSOR
                MOV     CURSOR,SI
                CALL    FIND_START      ;Find start of top of screen
                POP     CURSOR
LOCATE_FIRST:
                MOV     TOP_OF_SCREEN,SI
                MOV     CUR_POSN,DX
                CALL    CURSOR_COL
                MOV     SAVE_COLUMN,DL
                RET
LOCATE          ENDP

;-----------------------------------------------------------------
; This subroutine computes the correct column for the cursor.  No
; inputs.  On exit, CUR_POSN is set and DX has the row/column.
;-----------------------------------------------------------------
CURSOR_COL      PROC    NEAR
                MOV     SI,CURSOR       ;Get cursor offset
                CALL    FIND_START      ;Find start of this line
                MOV     CX,CURSOR
                SUB     CX,SI
                MOV     DX,CUR_POSN     ;Get current row
                XOR     DL,DL           ;Start at column zero
                MOV     MARGIN_COUNT,DL ;Count past the left margin
                JCXZ    COL_DONE
CURSOR_LOOP:
                LODSB                   ;Get the next character
                CMP     AL,CR           ;Is it the end of line?
                JE      COL_DONE        ;If end, were done
                CMP     AL,TAB          ;Is it a tab?
                JNE     NOT_A_TAB

                MOV     BL,MARGIN_COUNT
                OR      BL,00000111B
                MOV     MARGIN_COUNT,BL
                CMP     BL,LEFT_MARGIN  ;Inside visible window yet?
                JB      SOT_A_TAB       ;If not, don't advance cursor
                OR      DL,00000111B    ;Move to multiple of eight
NOT_A_TAB:
                MOV     BL,MARGIN_COUNT
                INC     BL
                MOV     MARGIN_COUNT,BL
                CMP     BL,LEFT_MARGIN
                JGE     OUT_OF_WINDOW
                INC     DL              ;Were at next column now
OUT_OF_WINDOW:
                LOOP    CURSOR_LOOP
COL_DONE:
                CMP     DL,COLUMNS      ;Past end of display?
                JB      COLUMN_OK       ;If not, were OK?
                MOV     DL,COLUMNS
                DEC     DL              ;Leave cursor at last column
COLUMN_OK:
                MOV     CUR_POSN,DX     ;Store the row/column
                RET
CURSOR_COL      ENDP

;-----------------------------------------------------------------
; This displays the string at CS:SI at the location in DX.  The
; remainder of the row is erased.  Cursor is put at the end of the line.
;-----------------------------------------------------------------
TTY_STRING      PROC    NEAR
                ASSUME  DS:CSEG
                PUSH    DX
                CALL    POSITION        ;Compute offset into video
                POP     DX
TTY_LOOP:
                LODSB
                OR      AL,AL           ;At end of string yet?
                JZ      TTY_DONE
                INC     DL
                PUSH    DX
                CALL    WRITE_INVERSE   ;Write in inverse video
                POP     DX
                JMP     TTY_LOOP
TTY_DONE:
                CALL    SET_CURSOR      ;Move cursor to end of string
                JMP     ERASE_EOL       ;Erase the rest of line
TTY_STRING      ENDP
```

(TED.ASM continues)



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Code #103

■ UTILITIES

```
;-----------------------------------------------------------------
; This copies the input filename to CS:DI and changes the extension
;-----------------------------------------------------------------
CHG_EXTENSION   PROC    NEAR
                ASSUME  DS:CSEG, ES:CSEG

                PUSH    SI
                MOV     SI,NAME_POINTER
CHG_LOOP:
                LODSB
                CMP     AL,"."          ;Look for the extension
                JE      FOUND_DOT
                OR      AL,AL
                JS      FOUND_DOT
                STOSB                   ;Copy a character
                JMP     CHG_LOOP
FOUND_DOT:
                MOV     CX,5            ;Five chars in extension
                POP     SI
                REP     MOVSB           ;Move new extension in
                RET
CHG_EXTENSION   ENDP

;-----------------------------------------------------------------
; This is the control break handler.  It ignores the break.
;-----------------------------------------------------------------
NEWINT23        PROC    FAR
                ASSUME  DS:NOTHING, ES:NOTHING
                MOV     CS:DIRTY_BITS,1
                CLC                     ;Tell DOS to ignore break
                IRET
NEWINT23        ENDP
```

```
;-----------------------------------------------------------------
; This is the asyncs error handler.  It homes the cursor before
; processing the error.
;-----------------------------------------------------------------
NEWINT24        PROC    FAR
                ASSUME  DS:NOTHING, ES:NOTHING
                PUSHF
                PUSH    AX
                PUSH    BX
                PUSH    DX
                MOV     CS:DIRTY_BITS,1
                XOR     DX,DX
                CALL    SET_CURSOR      ;Put cursor at home
                POP     DX
                POP     BX
                POP     AX
                POPF
                JMP     CS:OLDINT24
NEWINT24        ENDP
;-----------------------------------------------------------------
EVEN
NAME_DOT_$$$    EQU     $
NAME_DOT_BAK    EQU     $ + 004h
UNDO_BUFFER     EQU     $ + 1000h
LINE_BUFFER     EQU     $ + 2000h
NEW_STACK       EQU     $ + 5000h
CSEG            ENDS
;-----------------------------------------------------------------
FILE_SEG        SEGMENT
FILE_SEG        ENDS
END             START
```

(TED.ASM ends)

ately after discovering the error: the contents of the undo buffer are lost as soon as you move the cursor with the arrow keys.

The final three function-key editing commands work exclusively on the current line. Pressing F8, DEL EOL (DELete to End Of Line), erases everything to the right of the cursor except the line-ending CR/LF combination. To remove a line entirely, even if the cursor is not at the beginning of it, hit F9, DEL L (DELete Line). In both cases the deleted material is placed in the line buffer, where it can be recalled by pressing F10, the UDEL L (UnDELete Line) command.

Note that the line buffer is independent of the paste buffer and the undo buffer. This means you can cut a multiline section of text (storing it in the paste buffer) then delete and undelete individual lines without altering the paste buffer. The line buffer contents are maintained until either F8 or F9 is pressed.

DESIGN CONSIDERATIONS Since an editor is highly interactive, it's important that it process commands and display results as quickly as possible. Using the built-in BIOS video functions would make updating the display slow; speed dictates writing directly to the video memory.

A program that writes directly to the screen must take special precautions when dealing with the Color Graphics Adapter (CGA), however. To avoid excessive snow, writing must be restricted to the horizontal retrace period. The desnowing procedure is well known and actually quite simple, but it does add significant overhead that slows down the display. TED, therefore, uses desnow only if a CGA is in the system. One of its interesting features is that if any other adapter is being used, the code modifies itself, removing the unneeded wait intervals. This makes for even snappier screen updates.

Modifying an executable code at runtime involves inserting the proper machine instructions into the appropriate procedures. In this case a single JMP (opcode EBh) instruction is added to jump past the desnowing routines. The assembler computes the distance of the jump from the relative offset of the instruction labels HWAIT and WRITE_IT. Since the 80286 and 386 processors contain a prefetch queue, it's important not to modify instructions that are too close to the current instruction. TED makes its simple modification right at the start, thus avoiding this potential problem.

You shouldn't really be squeamish about self-modifying code. Microsoft's language compilers have used it for years. The most bizarre example I've found, however, is hidden in the DOS MODE command. MODE creates a small resident program that redirects parallel printer output to the serial port. If redirection is later changed or canceled, MODE searches for the resident portion of code and dynamically modifies the first couple of instructions.

Just being able to redraw the screen with lightning speed still wasn't good enough, however. Screen updates are still one of the slowest operations TED must perform, so I added some further optimization touches. Many programs falter when the Up or Down Arrow keys are held down to move rapidly through the file. The problem is that they can't scroll the screen as fast as the key auto-repeats. The inevitable result is an obnoxious beeping as the keyboard buffer overflows. Moreover, when the dust settles, you've inevitably gone too far and have to back up. TED prevents this by employing some look-ahead logic.

Whenever the entire screen needs to be redrawn (such as after using the PASTE command), a flag is set. Normally, screen updates are performed just before reading the keyboard. TED, by contrast, examines the keyboard buffer for any additional keystrokes *before* the screen is redrawn. If another command is pending, it is processed first. Since the screen is redrawn only after all pending commands have been handled, you can scroll through the file quickly without worrying about the display ever getting behind.

TED also makes it easy to use your EGA (or VGA) fully. It automatically adjusts for whatever screen dimensions you are using, packing as many rows and columns on the screen as will fit. Of course, the display must be set to one of the standard text modes. If you haven't yet tried more than 25 lines by 80 columns on your EGA (or VGA), see "Exploring the EGA, Part 2" in *PC Magazine*'s September 16,

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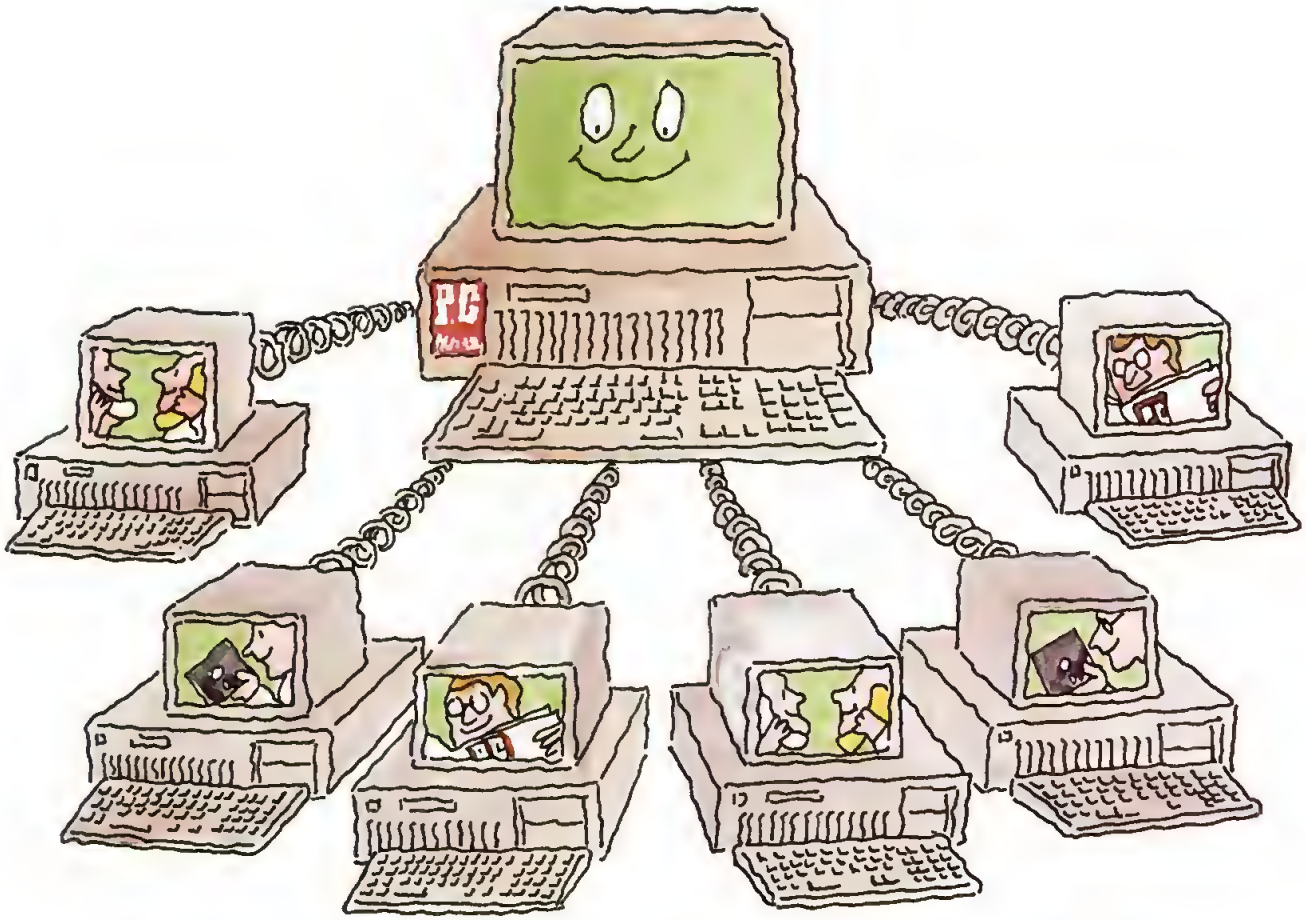
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TED.COM is already compiled and ready to run. TED.BAS will automatically create TED.COM when you run it once in BASIC. TED.ASM allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM TED;
LINK TED;
EXE2BIN TED TED.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

TED Command

Tom Kihlken 1988 No. 19 (Utilities)

Purpose: A small, full-screen editor for line-oriented files of up to 64K in length that supports scrolling, cut, copy, paste, and printing operations, and permits entry of all members of the IBM character set.

Format: `TED [filespec]`

Remarks: TED will open and read a file whose name (and path, if required) are supplied initially. If no *filespec* is provided, it will open a new file and prompt for a filename when F7 is pressed to save and exit. The original of a modified file is saved with a .BAK extension. The ABORT command (F1), when verified, abandons any modifications and leaves the original file intact.

Lines may be of any length, and each must be terminated by pressing Enter. Lines longer than the screen width display a diamond in the rightmost column. Offscreen characters (up to 248 columns) may be viewed by using the Ctrl–arrow keys. Lines may be broken by pressing Enter at any point, and may be conflated by pressing Del at the line end.

A block of text is defined by toggling the MARK command (F4) on and moving the cursor with the arrow keys. The marked area is shown in inverse video. Pressing F3 prints the blocked text; F5 (CUT) removes it to a buffer from which it can be pasted (F6) at any point where the cursor is located. The paste buffer remains intact until another section is marked and cut.

Pressing F8 deletes to the end of a line; F9 deletes the entire line. F10 restores the most recent deletion of F8 or F9. The UNDO command (F2) restores letters deleted by the Del (but not by the Backspace) key if the cursor has not been moved.

The Home and End keys move the cursor to the beginning and end of the current screen line; the Tab key moves to the next column evenly divisible by eight. Text is entered in insert mode by default; pressing the Ins key toggles to overstrike mode. TED configures itself to the display in use and supports EGA and VGA text modes other than the standard 80 columns by 25 rows. PgUp and PgDn scroll the file by the number of rows displayed, minus 5. Ctrl-PgUp and Ctrl-PgDn move to the top and bottom of the file.

Any character in the IBM set can be entered by pressing the Alt key, typing its ASCII value on the numeric keypad, then releasing the Alt key.

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■ UTILITIES

1986, issue for a host of programs that will show you how.

A couple of built-in safety features are included in the EXIT function to prevent file disasters. First, the filename you request is validated to preclude file-creation errors. (You wouldn't want to lose your entire file just because you accidentally typed "A;MEMO.TXT" instead of "A:MEMO.TXT".) One way to check for this is to scan the name for invalid characters. This doesn't catch the possibility of a nonexisting path, however. The method I've chosen uses the DOS CHMOD function to obtain the file's attribute. If an inva-

```
100 REM - BASIC PROGRAM TO CREATE TED.COM
110 CLS:PRINT "Creating TED.COM      ": OPEN "TED.COM      " AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM%=0
130 FOR I = 1 TO   187
140   LINESUM%=0: LOCATE 2,3: PRINT "Countdown: "   187 - I ;
150   FOR J = 1 TO  16: READ BYTE%: CHECKSUM%=CHECKSUM%+VAL("&H"+BYTE$)
160     LINESUM%=LINESUM%+VAL("&H"+BYTE$)
170     IF (BYTE < 256) THEN LSET A$=CHR$(VAL("&H"+BYTE$)): PUT #1
180   NEXT J
190   READ LINETOT%: LINECHECK% = VAL("&H"+LINETOT%)
200   IF LINECHECK% = LINESUM% THEN GOTO 220
210   LOCATE 4,2: PRINT "Error in line #"  ;  268 +  18 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT% : FILECHECK% = VAL(FILETOT%)
240 IF CHECKSUM% <> FILECHECK% THEN GOTO 260
250 PRINT: PRINT "TED.COM       created successfully": SYSTEM
260 PRINT: PRINT "TED.COM       is not valid!": END
270 DATA E9, 43,  1,  D,  A, 54, 45, 44, 28, 21, 2E, 30, 28, 28, 63, 29,  3A4
280 DATA 28, 31, 39, 38, 38, 28, 8A, 69, 66, 66, 28, 43, 6F, 6D, 6D, 75,  4CA
290 DATA 6E, 69, 63, 61, 74, 69, 6F, 6E, 73, 28, 43, 6F, 2E,  D,  A, 50,  52F
300 DATA 43, 28, 4D, 61, 67, 61, 7A, 69, 6E, 65, 28, 54, 6F, 6D, 5F, 54,  5FD
310 DATA 28, 4B, 69, 6B, 6C, 6D, 65, 6E, 24, 1A, 46, 69, 6C, 65, 28, 74,  538
320 DATA 6F, 6F, 28, 62, 69, 67, 24, 52, 65, 61, 64, 28, 65, 72, 72, 6F,  5A8
330 DATA 72, 24, 4E, 6F, 74, 28, 66, 6E, 6F, 75, 67, 68, 28, 6D, 65, 6D,  5CC
340 DATA 6F, 72, 79, 24, 31, 41, 42, 4F, 52, 64,  0, 32, 55, 4E, 44, 4F,  69F
350 DATA  0, 33, 58, 52, 49, 4E, 54,  0, 34, 4D, 41, 53, 4B,  0, 35, 43,  397
360 DATA 55, 54,  0, 36, 58, 41, 53, 54, 45,  0, 37, 45, 58, 49, 54,  0,  3CD
370 DATA 38, 44, 45, 4C, 28, 45, 4F, 4C, 2E, 39, 44, 45, 4C, 28, 4C,  0,  3E7
380 DATA 31, 30, 55, 44, 45, 4C, 28, 4C, 2E,  0, 4C, 6F, 73, 65, 28, 43,  3ED
390 DATA 68, 61, 6E, 67, 65, 73, 28, 28, 59, 2F, 4E, 29, 3F,  0, 63, 61,  4B8
400 DATA 76, 65, 28, 81, 73, 3A, 28,  0, 2E, 24, 24, 24,  0, 2E, 42, 41,  374
410 DATA 4B,  0,  1,  7, 78,  0,  8, FF,  0, 17,  0,  0,  0, 98, 81,  0,  2EA
420 DATA 81,  0,  0,  0,  0, 88,  0,  0,  0,  0,  0, FF, FF,  8,  0,  0,  32F
430 DATA  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0
440 DATA  0,  0,  0,  0, E7,  7, 9F,  7, 63,  7, BE,  6, D4,  6, 2C,  7,  3C1
450 DATA 23,  0, 87,  4, BE,  4,  0,  5, FD,  2, FD,  3, 66,  5, 91,  5,  47B
460 DATA 58,  4, FD,  3, 1D,  5, FD,  3, 48,  5, FD,  3, 7B,  5, ED,  5,  537
470 DATA 3D,  6, 61,  6, 64,  6, 23, C8, 8E, D8, E4, 12, E3, 18, CD, 18,  5D4
480 DATA 88, FE, 18, 74, 17, F6,  6, 87,  4,  8, 75, 18, 2E, C7,  6, 22,  547
490 DATA  9, E8,  3, A1, 84,  4, FF, C8, 2E, A3, E5,  1, A1, 4A,  4, 2E,  6BD
500 DATA A3,  8,  2, A1, 63,  4,  5,  6,  9,  E, 1F, A2, F2,  1, 3D, BA,  47A
510 DATA  3, 75,  8, C7,  6, 22,  9, E8, 3D, 17, C7,  6, F4,  1,  8,  52A
520 DATA E8, 32, FF, B4,  8, CD, 10, 88, 26, E3,  1, 88, F4, 77, 88, 26,  7AD
530 DATA E4,  1, 8A, A8, 11, E8, E3, 53,  F, E1,  4, E3, E8, 64, 8A, 8B,  8BD
540 DATA C0, 21, 8B,  8, 10, B4, CD, 21, E8, C0, B4, 4C, CD, 21, 73, 74,  74E
550 DATA 61, BA, 62,  1,  E, 1F, B4,  9, CD, 21, E9, 48,  6, A3,  A,  2,  4E6
560 DATA EE, 49,  8, 8A,  C, 32, ED, 46, 66,  3, F1, C6,  4,  8, 89, 36,  69C
570 DATA F8,  1,  6E, FC, E3, 42, AC, 3C, 20, 75,  2, E2, F9, 4E, 89, 36,  7D7
580 DATA EE,  1, 8E, D6, E8,  8, 3D, CD, 21, 72, 2D,  4, 1F, 8E, E8, 23,  88D
590 DATA 02, 84, 3F, 89, FE, FF, CE, 21, 8E, F8, 73,  5, BA, 57,  1, E8,  861
600 DATA E3, 88, 7D, FF, 1A, 76,  1, 4F, 2E, 89, 3E,  6,  2, 3E, CE, BA,  648
610 DATA 4A,  1, 74, BE, B4, 2E, CD, 21,  6,  6, 88, 24, 36, CD, 21, 2E,  574
620 DATA 89, 1E, 18,  2, 2E, 8C,  6, 12,  2,  E, 1F, 8A, 98,  C, E8, 24,  3EC
630 DATA 25, CD, 21, BA, 88,  C, EE, 23, 25, CD, 21,  7, 1F, E8,  6,  6,  569
640 DATA 2E, 89, 3E, E0,  1,  8, 74, 35, 2E, 88,  E, E2,  1,  4, 2E, E8,  4DE
650 DATA 16, FA,  1, 2E, 30, 16, E8,  1, 74,  6, 2E, C6,  6, E2,  1,  1,  471
660 DATA 2E, A1,  4,  2, 2E, 89, 1E,  9,  2, 3E, C3, 73,  E, 2E, A3, FC,  4F7
670 DATA  1, 2E, 89, 1E, FE,  1, E0,  9, 2E, A2, FE,  1, 2E, 84, 1E, FC,  46A
680 DATA  1, 2E, 8B, 16, FA,  1, 2E, 88, 36, E8,  1, E0, 8E,  6, 2E, F6,  642
690 DATA  6, E2,  1,  1, 74,  F, B4,  1, CD, 16, 76, 1A, E0, FE,  6, 2E,  5AC
700 DATA C6,  6, E2,  1,  8, 2E, F6,  6, E2,  1,  4, 74,  9, E0,  C,  6,  537
710 DATA 2E, C6,  6, E2,  1,  8, 32, E4, CD, 16,  A, C8, 74, 1C, 88, FC,  6AC
720 DATA  E, 74,  6, E8, 7C,  6, E9, 77, FF, 2E, 82, 3E,  4,  2,  8, 74,  5BA
730 DATA 1C, E0, 39,  1, E9, 82,  2, E9, 66, FF, 80, FC, 84, 76,  6, E8,  85E
740 DATA 63,  8, E5, 5E, FF, 88, FC, 76, 75,  6, E0, 75,  8, 84, 68, FF,  8A4
750 DATA 88, FC, 73, 74, 48, 88, FC, 74, 17, 88, FC, 63, 77, E8, 86, 8D4
760 DATA E8, 2C, 3E, 72, E8, D1, E8, 8B, D8, 2E, FF, 47, 14,  2, E9, 2F,  8A7
770 DATA FF, 2E, 8E, 3E, E6,  1, F7, 73, 19, 2E, 88,  6, E5,  1,  8, E8,  6DE
780 DATA ED,  7, 2E, 8E, 16, FA,  1, 2E, 88, 16, BA,  1, 2E, C6,  6, E2,  621
790 DATA  1,  1, E9,  E, FF, 2E, 88, 3E, E6,  1,  8, 74, F6, 2E, 88, 2E,  68C
800 DATA E5,  1,  8, E8, DA, 33, C8, 2E, A3,  4,  2, 2E, A3,  2,  2, 2E,  588
810 DATA A2, E6,  1, 2E, C6,  6, E2,  1,  1, 2E, A3, FA,  1, 2E, A2, BA,  6EC
820 DATA  1, C3, 2E, 8A, 36, E9,  1, 2E, 8B, 36,  6,  2, 2E, C6,  6, E6,  672
830 DATA  1,  8, E8, 17,  7, E8, DE,  8, 2E, C6,  6, E2,  1,  1, C3, 2E,  69C
840 DATA C8,  8, EC,  1,  8, 2E, FF, 26,  4,  2, E8, DE,  8, 6E, 2E, 8B,  6FF
850 DATA  E,  4,  2, 2E, 89, 36,  4,  2, E8, 16, 98, 2E, C6,  6, EC,  1,  47F
860 DATA  1,  8, E6,  6, 2E, 89, 36,  4,  2, 56, E8, 88,  8, 8E, CD, 6E,  64C
870 DATA 2E, CE,  A, ED, 74,  3, E9,  8,  1, 2E, 89,  E, FF,  1, E3, 24,  5E4
880 DATA 8F, AB,  E, 61,  6,  E,  7, F3, A4,  7, 5E, 2E, 8B,  E,  6,  2,  4A8
890 DATA 2E, 29,  8,  9,  2, 2E, 8E, 36,  4,  2, 8E, FE,  3, F8, 2E, CD,  4CF
900 DATA E3,  2, F3, A4, 2E, 8B, 16, FA,  1, 2E, 8E, 36,  4,  2, E8, 9E,  6DE
910 DATA  6, 2E, C6,  6, E2,  1,  1, C3, 2E, 88, 3E, EC,  1,  8, 74,  3,  4F7
920 DATA E8, 63,  8, 2E, A1, FF,  1, 8B, A8,  E, E9, 8F,  2, 2E, 83, 3E,  6DE
930 DATA  4,  2,  8, 74, 16, 2E, 8B, 16, FA,  1,  A, D2, 74, 16, 2E, FF,  4EC
940 DATA  E,  4,  2, E8, B9,  6, 2E, 88, 16, BA,  1, 2E, C7,  6, FF,  1,  666
950 DATA  8, 8A, C3, E8, 8E,  8, E8, 33, 2E, A3,  4,  2, 2E, 3E, 2E, 6A8
960 DATA  6,  2, 74, E7, 88, 3C,  D, 74,  7, 2E, FF,  6,  4,  2, E8, E3,  59E
970 DATA E8,  3,  9, E9, 87,  8, E9, FF,  6, 2E, 89, 36,  4,  2, 2E, C6,  62E
980 DATA  6, BA,  1,  8, 2E, C6,  6, FA,  1,  8, C3, 2E, 8B, 36,  4,  2,  49E
990 DATA E8,  3,  6, 2E, 89, 36,  4,  2, E8, 64,  6, 2E, 88, 16, BA,  1,  4EE
1000 DATA C3, 2E, C7,  6, F8,  1,  8,  8, 2E, 8E, 16, FA,  1, 2E, 8E, 36,  570
1010 DATA  4,  2,  A, F6, 74, 16, FE, CE, E8, 8E,  5, 2E, 84, 36,  4,  2,  5E6
1020 DATA E9, E5,  5, 2E, 84, 36,  4,  2, E9, 15,  5, C3, 2E, 8B, 36,  2,  54F
1030 DATA  2,  E, F6, 74, F6, E9, 77,  6, 2E, 89, 36,  2,  2, 2E, 8B, 36,  5B1
1040 DATA  4,  2, E8, 6A,  6, 2E, 89, 36,  4,  2, 2E, C6,  6, E2,  1,  1,  42E
1050 DATA 2E, 8E, 36,  4,  2, 2E, 8E, 16, FA,  1, E4, E7,  4, 2E, C7,  6,  58E
1060 DATA F8,  1,  8,  0, 2E, 8E, 16, FA,  1, 2E, 3A, 36, E9,  1, 2E, 8E,  5B4
1070 DATA 36,  4,  2, 74, 18, E8, 78,  5, 72,  A, 2E, 84, 36,  4,  2, FE,  48A
1080 DATA C6, E8, C8,  4, C3, 2E, 3E, 36,  8,  2, 74, F8, E8, 49,  6, 2E,  6AC
1090 DATA 89, 36,  4,  2, E8, 61,  6, 72, E1, 2E, 84, 36,  4,  2, 2E, 8E,  4D2
1100 DATA 36,  2,  2, E8, 42,  5, 2E, E9, 36,  2,  2, E8, 9D, 2E, C7,  6,  4DD
1110 DATA  E,  2, ED,  5, 2E, 8A,  E, E9,  1, 88, E9,  5, 32, ED, 51, 2E,  5BE
1120 DATA FF, 16,  E,  2, 69, E2, F7, C3, 2E, C7,  6,  E,  2, 93,  5, E8,  6A6
1120 DATA E3, 2E, F6, 16, E7,  1, E9, ED,  2, 2E, 8B,  E,  6,  2, 2E, 8E,  665
1140 DATA 36,  4,  2, 8B, FE, 3E, F1, 73, 1E, AC, E8, 56,  1, 8A, 24, 58,  668
1150 DATA 2E, FF,  E,  6,  2, 2B, CE, F3, A4, 58, 3C,  D, 74,  7, 2E, 88,  59D
1160 DATA  E, E2,  1,  4, C3, 88, FC,  A, 75,  3, E8, CC, FF, E8, 15,  3,  769
1170 DATA 2E, 8B, 16, FA,  1, 2E, 88, 16, BA,  1, C3, 33, C8, 2E, F6, 16,  671
1180 DATA E8,  1, 2E, 38,  6, E0, FC,  A, 75,  F, 2E, C6,  6, E2,  1,  1,  2E,  4CE
1190 DATA C7,  6, FC,  1, FF, FF, E8,  8, 2E, A1,  4,  2, 2E, A3, FC,  1,  75E
1200 DATA 2E, A3, FF,  1, 2E, A3,  8,  2, C3, 2E, 88, 3E, E8,  1,  8, 74,  5AF
1210 DATA 4A, 2E, 8B,  E, FF,  1, 2E, 8B, 36, FC,  3, 2B, CB, 2E, 89,  E,  5BA
1220 DATA  C,  2, E3, 37, 33, FF, 51,  6, 2E, 8E,  6,  A,  2, F3, A4,  7,  51D
1230 DATA 58, 2E, 8B,  E,  6,  2, 2E, 29,  6,  6,  2, 2E, 8B, 3E, FC,  1,  388
1240 DATA 2E, 8E, 36, FE,  1, 2B, CE, E3,  2, F3, A4, 2E, 8B, 16, FA,  1,  72D
1250 DATA 2E, 8E, 36, FC,  1, E8, 74,  4, E8, 88, FF, C3, 2E, A1,  C,  2,  753
1260 DATA  B, C8, 74, 2E, 2E, 8B, 36,  4,  2, 58, 56, E8, 77,  3, 6F, 89,  522
1270 DATA 72, 28, 33, F6, 1E, 2E, 8E, 1E,  A,  2, F3, A4, 1F, 8D, F7, 2E,  625
1280 DATA 89, 36,  4,  2, 2E, 8B, 16, FA,  1, E8, 48,  4, 2E, C6,  6, E2,  597
1290 DATA  1,  1, C3, 2E, 88, 3E, E8,  1,  8, 74, 33, 2E, 8B,  E, FE,  1,  507
1300 DATA 2E, 8B, 36, FC,  1, 2B, CE, E3, 22, B4,  2, 33, D2, CD, 17, F6,  77F
1310 DATA C4, 88, 74, 17, F6, C4, 28, 75, 12, AC, 32, E4, CD, 17, D8, CC,  872
1320 DATA 72,  4, E2, F5, E8,  D, 88, F4,  8, CD, 17, E8,  E, FF, C3, 33,  851
1330 DATA C8, 2E, 87,  6, F8,  1, BE, A8,  D, E8,  1, 48, 56, 2E, 8B, 36,  6A8
1340 DATA  4,  2, 58, 56, E8, FE,  2, 5F, 64, 5E, 72, 16, 1E,  E, 1F, F3,  578
1350 DATA A4, 8B, 36,  4,  2, 8B, 16, FA,  1, C6,  6, E2,  1,  1, 1F, E8,  5BE
1360 DATA CA,  3, C3, 2E, 8B, 1E, F8,  1,  A, FF, 75,  A, 2E, FF,  6, F8,  713
1370 DATA  3, 2E, 88, 87, A8,  D, C3,  E, 1F, 8A, 26, E8,  1, FE, C4, 32,  683
1380 DATA D2, BE, BA,  1, E8, 68,  6, 32, E4, CD, 16,  C, 28, 3C, 79, 74,  6E5
1390 DATA  6, E8, 52,  1,  6, 1F, C3, 8A, 36, E9,  1, 32, D2, E8, 1C,  1,  5DC
1400 DATA FF, C6, E8, 2D,  1,  E, 1F, BA,  3,  1, 84,  9, CD, 21, E8,  8,  628
1410 DATA 4C, CD, 21, 1E,  6, 8C, C8, 8E, D8, 8E, C6, 8A, 36, E4,  1, FE,  88E
1420 DATA C6, 32, D2, BE, CD,  1, 52, E8, 1D,  4, 8A, 88, C2,  9, 8B, 36,  718
1430 DATA EB,  1, E8, 12,  4, 32, E4, CD, 16, 8B, 3E, FF,  1,  A, C8, 74,  6DE
1440 DATA DA, 3C, 1B, 75,  A, C6,  6, E2,  1,  1,  7, 1F, E9, F7,  8, 3C,  5A2
1450 DATA  D, 74, 23, 3C,  8, 75, 18, 3E, 3E, EB,  3, 7E, BE, C6, 45, FF,  61E
1460 DATA  8, FF,  E, FF,  1, E8, 84, 81, FF, C2,  8, 7F, AE, 22, E4, AB,  8CD
1470 DATA FF,  6, F8,  1, EB, A5, 8B, 16, EE,  1, E8,  8, 43, CD, 21, 72,  772
1480 DATA  5, 3D,  3,  9, 74, 15, BE, D8,  1, EF, A8,  C, E8, D1,  3, BA,  64B
1490 DATA A8,  C, E4, 3C, E9, 28,  8, CD, 21, 73,  E, E8,  7,  E, CD, 18,  596
1500 DATA E9, 78, FF, B4, 3E, CD, 21, E8, F2, 33, D2, 8E,  E,  6,  2, 8E,  84E
1510 DATA F9, 8E, D8, E4, 48, 1F, 83, F9, FF, 74,  4, 41, C6,  5, 1A, CD,  855
1520 DATA 21, 1F, 72, DF, 3B, C1, 75, D8,  E, 1F, E4, 3E, CD, 21, BE, DD,  785
1530 DATA  3, BF, 28,  D, E8, 85,  3, 8A, 28,  D, E4, 41, CD, 21, BF, 28,  622
1540 DATA  E, 8E, 16, E8,  1, B4, 56, CD, 21, 8B, 3E, E8,  1, BA, A8,  C,  688
1550 DATA E4, 56, CD, 21, 68, 58, E9, FE, FE, 2E, BA, 3E, E4,  1, EE,  5,  858
1560 DATA 2E, 8A, 3E, E3,  1, 8A, D8,  E, 2B, 8B, 16, F2,  1,  2, EE, E8,  3C6
1570 DATA F4,  1, EC,  1, C8, 73, FE, 8E, E3, 8E,  7, C3, 32, FF, B4,  6,  491
1580 DATA CD, 21, 72, 2E, A1,  4, 2E,  6, E6, 33, F6,  3, C2, D1, E8, 8B,  87E
1590 DATA F8, C3, E8, E8, FF, 2E, 8B,  E,  8,  2, 2A, CA, B2,  7, B8, 2E,  88F
1600 DATA E8, BD, FF, E2, FF, C3, 1E,  E, 1F, 8A, 36, E9,  1, FE, C6, 32,  42D
1610 DATA E2, E8, CF, FF, EC, 76,  1, E8, 46, E8, A4, FF, AC,  A, C8, 74,  A26
1620 DATA 1E, 89, 8C, FF, 2E, 88, 3C, 2E, 78,  6, AC, 88, 82, FF, AC,  A,  88F
1630 DATA C8, 75,  7, E8, 2E, E8, 88, FF, EB, DD, E8, 7C, FF, E8, EF, 8A,  88A
1640 DATA 36, E9,  1, FE, C6, E2, 4F, E8, A8, FF, B8, 4F, 88, 3E, E7,  1,  819
1650 DATA  8, 74,  2, E8, 49, 4F, 4F, E8, 66, FF, 1F, C3, 2E, 8E, 36,  2,  62D
1660 DATA  2, 32, F6, EE,  8, E8, E8,  1, 2E, 8E, 16, FA,  1, 52, E8, 12,  6CD
1670 DATA  8, 5A, FF, C6, 2E, 3A, 36, E9,  1, 76, F2, C3, E8, 99,  1, 2E,  781
1680 DATA 8B, 16, FA,  1, 32, D2, 2E, 88, 16, E6,  1, 8E, CA, E8, 53, FF,  7E2
1690 DATA 2E, 8E, 36,  6,  2, 73, 20, AC, 3C,  D, 74, 1D, 3C,  9, 74, 24,  3A5
1700 DATA E8,  2,  8, 2E, 3A,  E,  8,  2, 72, E6, 88,  C, 8E,  E, 74,  7,  4F5
1710 DATA 4F, 88,  4, E8,  3, FF, E9, 6F,  1, AC, 2C,  A, 74,  1, 4E, 8B,  686
1720 DATA E1, E9, 2E, FF, E8, 28, E8,  C,  8, 2E, A8, E6,  1,  2, C1, A8,  7CB
1730 DATA  7, 76, F1, EB, CB, 2E, BA, 1E, E6,  1, 2E, 3A, 1E, E6,  1, 73,  6C2
1740 DATA  8, FE, C3, 2E, 88, 1E, E6,  1, C3, 2E, 3B, 36, FC,  1, 76,  C,  666
1750 DATA 2E, 3E, 36, FE,  1, 77,  5, E8, BF, FE, E8,  3, B8, C1, FE, FE,  952
1760 DATA C1, C3, 2E, 8B, 36,  4,  2, 3C,  D, 74, 43, 2E, 8B, 36,  4,  2,  66E
1770 DATA 2E, 8B, 3E, E7,  1,  8, 76, 16, 88, 3C,  D, 74, 18, 2E, 3E, 36,  64A
1780 DATA  6,  2, 74,  9, 8B, FE, 86,  4, E8, 68, FD, E8,  D, 56, 58, E8,  72B
1790 DATA  1,  8, E8, 38,  9, 58, 5F, 72, 14, BE, 2E, 88,  E, E2,  1,  4,  6A3
1800 DATA 2E, FF, 36, FF,  1, E9, 88, FA, 2E, 8F,  6, F8,  1, C3, 56, E8,  87B
1810 DATA  2,  8, E8, 18,  9, 5F, 72, F5, E8,  E,  A, AB, E8,  6, FF, E9,  78F
1820 DATA B4, FA, E4, 38, FE, 2E, 89,  E,  6,  2, 8E, F1, 8B, F4,  3, F8,  894
1830 DATA 72, 11, 2E, 89, 3E,  6,  2, 2E, 2E,  E,  4,  2, 4F, 4E, FD, F3,  47A
1840 DATA FC, F8, C2, 2B, 8A,  E, BA,  1, 2E, ED, 8E, E9, 2E,  2,  E,  E,  7DD
1850 DATA E5,  1, 8B, D5,  8, 32, D2, 2E, 89, 16, FA,  1, E3, 2A, 51, 88,  685
1860 DATA 3C,  E, 74,  3, E8, 61, FA, 69, 2E, A8, BA,  1, 32, E4, 3D, C1,  717
1870 DATA 7C,  E, 2E, 8E, 16, FA,  1, 32, F6, 3B, D5, 74,  4, 77,  A, E2,  666
1880 DATA DD, 8B, CD, 2E, 88,  E, BA,  1, C3, E8,  1, FA, 8B, CD, 2E, 88,  848
1890 DATA E, 8A,  1, C3, 2E, 88, 1E, E6,  1, C3, 12, 88, 3C,  E, 75,  E,  636
1900 DATA 49, 2E, 3B, 36,  6,  2, 73,  6, 88, 3C,  A, 76,  1, 46, C3, 2E,  324
1910 DATA FF, 36,  4,  2, E8,  E,  8, 2E, 89, 36,  4,  2, E8, 19,  8, 2E,  463
1920 DATA 8F,  6,  4,  2, C3, 51, B8,  D, 8B, FE, 8B, CB, E3,  9,  4F, FD,  785
1930 DATA F2, BE, FC, 47, 8B, F7, 64, C3, 2E, 8B, 36,  4,  2,  9, F6, 74,  78B
1940 DATA  6, E8, E3, FF, E8, AD, FF, C3, 51, E8,  8,  8, 72,  4, E8, A3,  967
1950 DATA FF, FF, 69, C3, B8,  D, 2E, 8E,  E,  6,  2, 2B, CE, 8E, FE, E3,  884
1960 DATA  4, F2, BE, 8E, F7, E3,  3, 4E, F8, C3, FF, C3, 8A, CE, 32, ED,  A4D
1970 DATA 2E, 89, 36,  4,  2, 33, D2,  E, F6, 74, 31, E8, 8A, FF, 33, D2,  744
1980 DATA FF, 74, 2B, E3, 26, 66, 61, E8, 9A, FF, 59, 58, 88, 3C,  D,  74B
1990 DATA 76, 1A, 3E, FF, 74,  4, FF, C6, E2, EC, 2E, FF, 26,  4,  2, 2E,  76B
2000 DATA 89, 26,  4,  2, E8, 91, FF, 2E, 8F,  6,  4,  2, 2E, 89, 36,  2,  4F5
2010 DATA  2, 2E, 89, 16, FA,  1, E9,  6,  8, 2E, 88, 16, BA,  1, C3, 2E,  568
2020 DATA 8B, 26,  4,  2, E8, 71, FF, 2E, 8B,  E,  4,  2, 2B, CE, 2E, 8E,  69E
2030 DATA 16, FA,  1, 32, D2, 2E, 88, 16, E6,  1, E3, 37, AC, 3C,  D, 74,  64B
2040 DATA 32, 3C,  9, 75, 17, 2E, 8A, 1E, E6,  1, 80, CB,  7, 2E, 88, 1E,  4B6
2050 DATA E6,  1, 2E, 3A, 1E, E6,  1, 72,  3, 88, CA,  7, 2E, 8A, 1E, E6,  6D5
2060 DATA  1, FE, C2, 2E, 88, 1E, E6,  1, 2E, 3A, 1E, E6,  1, 76,  2, FE,  66F
2070 DATA C2, E2, C9, 2E, 3A, 16,  8,  2, 72,  7, 2E, 8A, 16,  8,  2, FF,  644
2080 DATA CA, 2E, 89, 16, FA,  1, C3, 62, E8, E8, FC, 5A, AC,  A, C8, 74,  BA7
2090 DATA  8, FE, C2, 52, E8, A2, FC, 6A, E8, F2, E8, BF, FC, E9, D2, FC,  C32
2100 DATA 66, 88, 36, 8E,  1, AC, 3C, 2E, 74,  7,  A, C8, 74,  3, AA, E8,  66D
2110 DATA F4, B9,  6,  8, 5E, F3, A4, C3, 2E, C6,  6, E2,  1,  1, F8, CF,  88F
2120 DATA 9C, 58, 63, 62, 2E, C4,  6, E2,  1,  1, 33, D2, 8E, 8D, FC, 8A,  73F
2130 DATA 5E, 58, 9D, 2E, FF, 2E, 10,  2,  8,  8,  8,  8,  8,  8,  8,  8,  2ED
2140 DATA 298814
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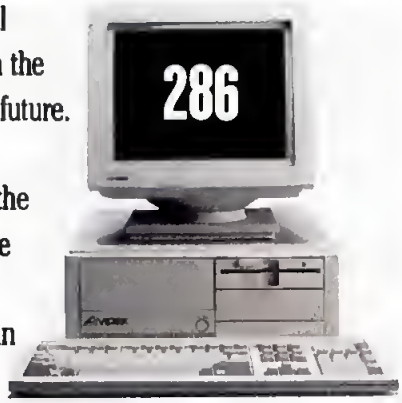
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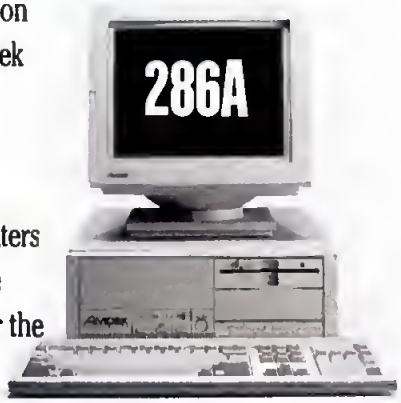
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lid filename is used, the call returns error code 3 (path not found). The speaker is then beeped, and you're given a chance to enter another name.

Next, the new file is written into a scratch file. If (and only if) the temporary file is successfully written, an existing .BAK file is deleted and the original becomes the new backup. Finally, the temporary scratch file is renamed to the name you selected. This fancy footwork is required to avoid deleting the original before the latest changes are saved. Most editors use a similar technique. In case you're wondering, the scratch filename is the starting name with a .$$$ extension.

ANATOMY OF AN EDITOR To keep TED's code as small as possible, I resisted using dynamic memory allocation and decided to use one entire segment to hold the file. Since the maximum segment size on the Intel 8086 is 64K, files larger than that cannot be processed. A second segment is used for the paste buffer, bringing TED's total memory requirement to about 131K. If DOS is unable to allocate this much, the program exits with the error message "Not enough memory."

The main advantage of this system is that there is no need for active memory management: all memory allocation is performed at initialization time. A second advantage is that the individual lines of the file need not be separated, making it easy to read and write the entire file in a single pass. The 64K size limit is common in many other programs for similar reasons. In fact, even with OS/2 (which runs on the Intel 80286 processor), individual segments will *still* be limited to 64K.

This simple memory model has its disadvantages as well. Each time a character is inserted into the file, all characters following it must be shifted ahead one position to make room. Similarly, deleting characters requires moving all following characters forward in the file. When editing large files, you'll notice this does cause a slight delay as you type, though the lag is difficult to detect on an AT-class machine.

Another disadvantage is that the locations of individual lines are not known. To move the cursor down requires searching for the next carriage return. To complete the cursor movement, the cursor is shifted right until it's in the same column from which it started. This proved to be a minor programming chore, but the procedures FIND_NEXT and FIND_PREVIOUS take care of it completely.

A handful of variables are used to maintain the file segment. Most important are the number of characters that are contained in it and the current cursor location. The number of characters is initialized when the file is read in and adjusted each time a character is added or deleted. PASTE, UNDO, and UDEL L also affect the char-

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acter count. The variable CURSOR marks the character position where the flashing cursor is placed. Most of the editing commands work at this location.

Another data item is needed to maintain the screen position of the file. The variable TOP_OF_SCREEN contains the offset of the first character on the top row. This marker facilitates redrawing the screen after a command such as PRINT, PASTE, or CUT. Initially it points to the start of the file buffer and is advanced a line at a time as the display scrolls. The location of the bottom line is *not* stored, since this can be easily computed by counting lines forward from the top marker. The current row and column position of the cursor complete the vital statistics.

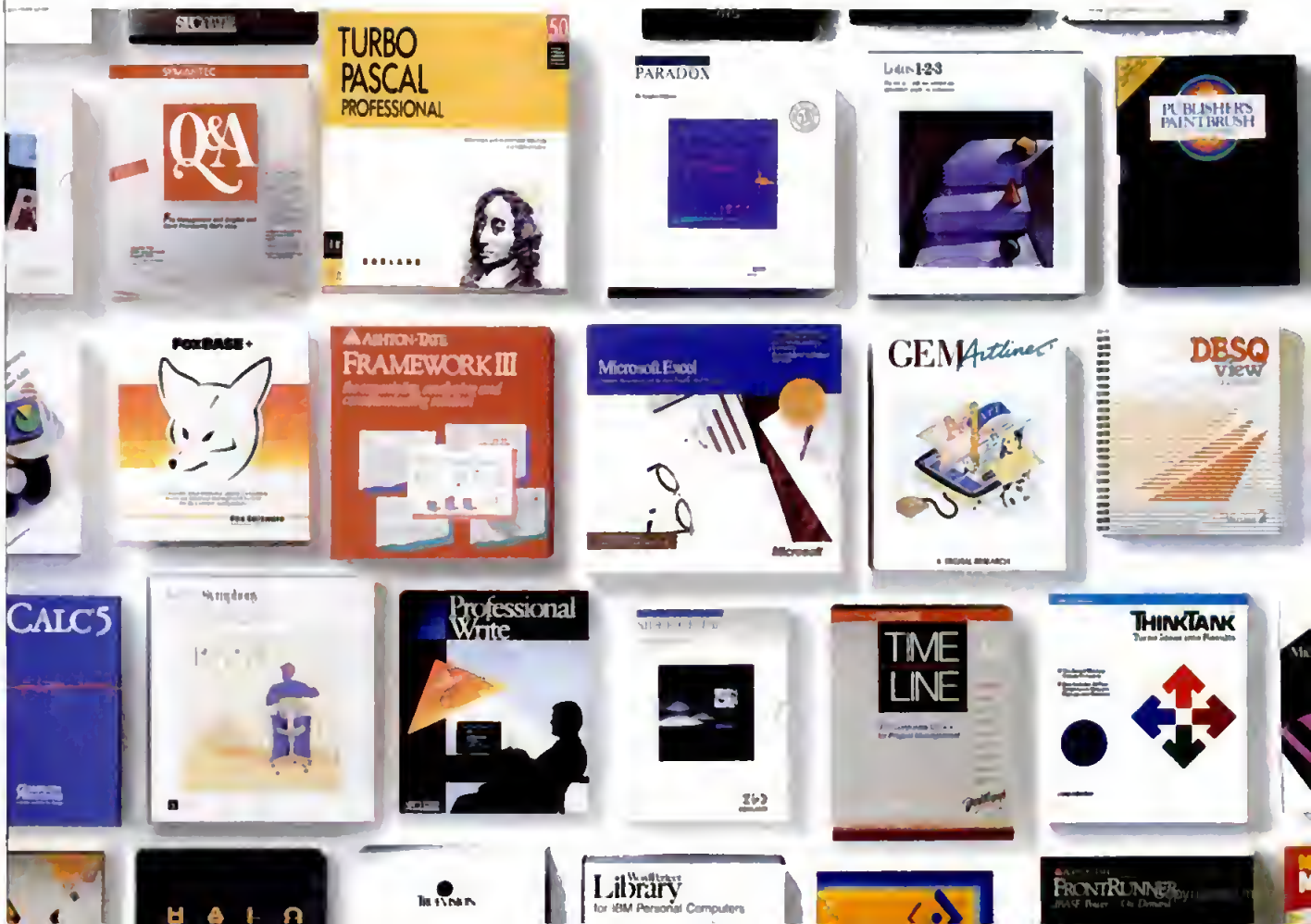
PROGRAMMER'S NOTEPAD As you examine the source code, you'll find many examples of modular programming. For example, the RIGHT procedure advances the cursor one character in the file. It is called to advance the cursor both when the Right Arrow is pressed and after a normal character is inserted. Most of the editing functions are similarly built from the primitive cursor movement routines. Reusable procedures are extremely important in developing complex programs. Without them, TED certainly wouldn't be the tiniest editor.

Implementing the MARK, CUT, and PASTE functions required considerable logic. The program must keep track of the beginning and end of the marked region so it can be displayed in inverse video. Pointers are used to mark the start, end, and anchor points of the marked region. The anchor point is established when the MARK key is first pressed. It never changes. The end point is normally the current cursor location. It changes each time the cursor is moved. A complication arises when the cursor is moved backward from the anchor point. When this happens, the start and end points are swapped, using the anchor point as the end and the current cursor location as the start point.

The Tab key is interpreted as a special command. Dealing with tabs causes two problems. First, displaying the tab character requires special handling. Normal characters can be copied directly to the video buffer where they are displayed by the video hardware. But tabs must be converted into one or more spaces to be processed.

To show a tab, a space is displayed first. The column number is then examined, and additional spaces are inserted until the column is an even multiple of eight. Testing the rightmost three bits of the column count is a quick way to determine that you're on a multiple of eight. When the screen is shifted sideways, it moves in multiples of eight. This prevents tabs from straddling into the nonvisible margin.

The second problem with tabs is that



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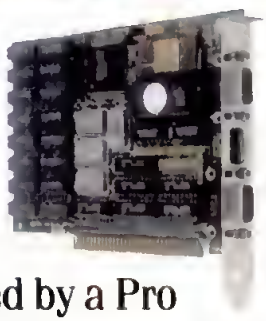


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they destroy the one-to-one correspondence between columns and characters. Without tabs, programming the arrow keys would be trivial, each keystroke moving one column. But the Left/Right arrows always move one character position. If that character happens to be a tab, the cursor should move more than one column on the display. To resolve this problem, the correct column for the cursor must be computed after each keystroke. Despite these difficulties, the importance of using "real" tabs made them worth including.

An unexpected cosmetic problem arose when I first used TED to view a file. It's traditional for text files to have an end-of-file (EOF) marker (ASCII 26) as their last character. DOS commands like TYPE and COPY ignore this character. But TED displayed it as a strange-looking symbol at the

■ Even if you've been using the most powerful word processor, you'll appreciate TED's speed.

end of the file. To prevent this, immediately after reading the file TED examines the last character. If it is the EOF mark, the number of characters is reduced by one, stripping it off. Later, when the file is written, the EOF mark is again added. A related problem can arise because some editors ignore "garbage" after the EOF marker by not reading past it. But TED reads the entire file recorded by DOS. If you find such "junk" at the end of an otherwise good file, however, you can safely delete it.

There is a chance of an inadvertent Ctrl-Break wiping out a file. Normally DOS interprets Ctrl-Break as a signal to terminate the current program and return to the command line. To prevent this, TED redirects the interrupt 23h handler. By pointing it to a dummy return instruction, DOS never knows it happened.

The interrupt 24h vector is also redirected. This interrupt is issued by DOS in the event of a severe disk error and issues the sobering "Abort, Retry, Ignore" mes-

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sage. Although TED can't do anything about the error, it makes it a little less obtrusive by moving the cursor to the top row, preventing the screen from scrolling upward. A flag is also set indicating that the screen needs to be redrawn when the editor regains control. Both of these interrupt vectors are restored automatically by DOS when the program terminates.

I have included an assembler directive that is designed to enhance the performance of the program on CPUs with 16-bit data buses (such as the 8086, 80286, and 80386). The EVEN keyword causes the assembler to align the data at an even-byte boundary. Fetching 16 bits can be done with a single memory access only if it is byte aligned. Failing to ensure alignment decreases the memory access speed unnecessarily. Since I have relocated the stack, it is important to align the new stack on an even boundary.

Finally, let's take one last look at the screen-drawing logic. For each keypress there are three possible outcomes. When a normal key is pressed, the current line needs to be redrawn, showing the new character. It may seem wasteful to redraw the entire line, but this simplicity keeps the program short. The second case arises when the carriage return is pressed. It is processed similarly, but it requires shifting the bottom of the display downward to make room for the new line. Although the BIOS provides the capability of scrolling any portion of the screen, again the simpler logic of redrawing all lines following the cursor is used. The third case involves special functions, such as PgUp, which require repainting the entire screen. Although these functions could also be implemented using scrolling logic, again the display is completely redrawn. It should now be obvious why the display routines must be tightly coded for maximum execution speed.

Your editor should be your best friend. If your relationship with EDLIN has been anything less, give TED a try. Even if you've been using the most powerful word processor, you'll appreciate TED's speed and simplicity. I found myself using it to add the finishing touches to this article. PC

Tom Kihlken is a frequent contributor to the Productivity section of PC Magazine.

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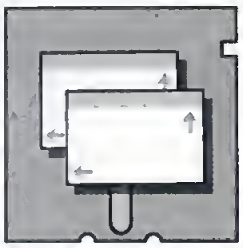
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■ ENVIRONMENTS ■ CHARLES PETZOLD

TEACHING THE PM TO SAY "HELLO"



Presentation Manager programs often seem to require a lot of code. Most of the overhead is standardized, however, providing a display flexibility simpler programs can't match.

Brian Kernighan and Dennis Ritchie begin their classic book, *The C Programming Language*, with what has come to be known as the "Hello, world" program. This program (modified somewhat so it will compile without warning messages using the −W3 switch of Microsoft C 5.1) is shown in Figure 1.

You can compile HELLO.C for either DOS or OS/2. Under OS/2 1.1 (scheduled for release in October 1988), you can run an OS/2 version of HELLO.EXE either in a full-screen character-mode session or in a window in the graphical Presentation Manager environment. But even though an OS/2 version of HELLO.EXE can run in a PM window, it's not a PM program. It can't use graphics or any other facility of the Presentation Manager.

A PM version of the "Hello, world" program is, well, not quite as simple as HELLO.C. And as programmers begin grappling with the complexities of the OS/2 Presentation Manager in the months ahead, you're likely to hear them grousing, "You need 100 lines just to write a 'Hello, world' program."

Not quite. A Presentation Manager version of "Hello, world" requires only about 40 lines of C code—maybe a little more if you count blank lines and comments and you put curly brackets on their own lines. But 40 lines still seems like a lot of code just to say "Hello."

A LOT OF LINES Yes, it is. But perhaps the real question is why the simple HELLO.C program requires so few lines.

The keyboard input and screen output facilities of the C standard library are based on a Teletype model. I suspect that most of today's personal computer users have never even seen a Teletype, let alone used one. These relics look and work something like a typewriter. You type in the name of the program you want to run (HELLO) at a command line prompt, and the Teletype skips to the next line of the paper and runs the program. The program prints "Hello, world," skips to the next line, and the prompt reappears.

It's nearly the same when you run HELLO.EXE on your PC, except that the video display replaces the paper. The program displays its output wherever the cursor is positioned when you run the program.

HELLO.EXE terminates soon after it displays its output. Yet the output is still visible and will be visible until another program clears the screen or the output scrolls off the top. This is rather odd. The program has terminated, but it leaves behind traces of its passing.

Of course, most applications for the PC use the full screen. So to make our comparison fair, let's convert HELLO.C into FSHELLO.C, a somewhat more modern full-screen character-mode program.

When the program begins to execute, you want it to clear the screen. If you're writing the program for OS/2, that requires a call to VioScrollUp. Next, let's display the "Hello, world" text in the center of the screen. You call VioGetMode to get the dimensions of the screen, do some calculations, and call VioSetCurPos to set the cursor. Now you can call `printf`. You don't want to terminate the program immediately. You probably want to wait for a keystroke from the user. That's a call to KbdCharIn. When you get the keystroke, clear the screen with VioScrollUp.

We're up to six function calls now, but we're not quite done. A full-screen program usually protects itself from being terminated by Ctrl-Break or Ctrl-C. To do that you call DosSetSigHandler. That's seven function calls and over 20 lines of code, as shown in Figure 2.

```
/*-----------------------------------------
   HELLO.C -- Standard "Hello, world" Program
  -----------------------------------------*/

#include <stdio.h>

int main (void)
     {
     printf ("Hello, world\n") ;

     return 0 ;
     }
```

Figure 1: *HELLO.C is often the first C program that a programmer learns.*

PM "HELLO, WORLD" PROGRAM

Compared with the 20 lines of FSHELLO.C, the 40 lines of code required for a Presentation Manager version of the "Hello, world" program seem much less unreasonable. As we'll see, the PM version will have two functions (the `main` function and a function called ClientWndProc) and will make 14 function calls—just twice as many as the FSHELLO.C program. Of these 14 functions, 11 can be classified as overhead—code that is present in virtually every Presentation Manager program.

A Presentation Manager version of "Hello, world" is shown in Figures 3 and 4. I've divided the program into two source code modules, PMHELLO.C and PMHELLO1.C. These can be compiled separately and linked to create PMHELLO1.EXE. (The mechanics of compiling and linking will be discussed at the end of this column.) Of course, the program could have been written in just one source code module.

When you run PMHELLO1 under the Presentation Manager, it creates a window and displays the text "Hello, world" in the center, as shown in Figure 5. This window incorporates a complete Presentation Manager interface: you can move the window, resize it, minimize it to an icon, or maximize it to fill the whole screen. Whenever the window size changes, the program redraws the text in the window's center.

INITIALIZATION AND CLEANUP

The PMHELLO.C file contains the `main` function, which is the entry point of the program. The nine functions called in `main` will be found in virtually every Presentation Manager program. In fact, I'll use this same module for the PMHELLO2 and PMHELLO3 programs discussed below. Of course, other Presentation Manager programs may call these same functions with somewhat different parameters.

I won't discuss these nine functions in detail here. For now, just try to get the gist of what's going on. All the functions begin with the prefix Win, which refers to the windowing and user interface part of the Presentation Manager.

Most of the functions called from `main` can be considered in pairs. The WinInitialize and WinTerminate functions consti-

```
/*--------------------------------------------------------------
   FSHELLO.C -- Full-Screeo Charsctsr-Mode "Hsllo, world" Program
                (c) 1988, Ziff Communications Company
                PC Magasine * Charlss Petsold, July 1988
  --------------------------------------------------------------*/

#define INCL_DOS
#define INCL_KBD
#define INCL_VIO
#include <os2.h>
#include <stdio.h>

iot main (void)
     {
     ststic chsr    ssText[] = "Hsllo, world" ;
     KBDKEYINFO     kbci ;
     PFNSIGHANDLER pfnPrevSigHandlsr ;
     USHORT         usPrevAction ;
     VIOMODEINFO    viomi ;

     DosSetSigHandler (NULL, &pfnPrevSigHandler, &usPrsvAction,
                       SIGA_IGNORE, SIG_CTRLC) ;

     VioScrollUp (0, 0, -1, -1, -1, " \x7", 0) ;
     viomi.cb = sizeof viomi ;
     VioGetMode (&viomi, 0) ;
     VioSstCurPos (viomi.row / 2, (viomi.col - sizeof ssText - 1) / 2, 0) ;

     printf (ssText) ;
     KbdCharIn (&kbci, IO_WAIT, 0) ;

     VioScrollUp (0, 0, -1, -1, -1, " \x7", 0) ;
     return 0 ;
     }
```

Figure 2: *This full-screen character-mode version of the "Hello, world" program centers the text in the screen and waits for a keystroke before terminating.*

```
/*--------------------------------------------------------------
   PMHELLO.C -- OS/2 PN "Hello, world" Program -- main() Function
                (c) 1988, Ziff Communications Company
                PC Magasine * Charles Petsold, 7/88
  --------------------------------------------------------------*/

#include <os2.h>

MRESULT EXPENTRY ClientWndProc (HWND, USHORT, MPARAM, MPARAM) ;

int main (void)
     {
     static CHAR szClientClass [] = "PMHello" ;
     HAB         hab ;
     HMQ         hmq ;
     HWND        hwndFrame, hwndClient ;
     QMSG        qmsg ;
     ULONG       flFrameFlags = FCF_STANDARD & ~FCF_MENU ;

     hab = WinInitialise (0) ;
     hmq = WinCreateMsgQueue (hab, 0) ;
     WinRegisterClass (hab, szclientclass, ClientWndProc, CS_SIZEREDRAN, 0) ;

     hwndFrame = WinCreateStdWindow (HWND_DESKTOP, WS_VISIBLE,
                                     &flFrameFlags, szclientclass,
                                     "OS/2 PN \"Hello, world\" Program",
                                     0L, NULL, 0, &hwndClieot) ;

     while (WinGetNsg (hab, &qmsg, NULL, 0, 0))
          WinDispatchMsg (hab, &qmsg) ;

     WinDestroyWindow (hwndFrame) ;
     WinDestroyNsgQueue (hmq) ;
     WinTerminate (hab) ;
     return 0 ;
     }
```

Figure 3: *The main function of a Presentation Manager program performs initialization, creates a window, retrieves messages from a queue, and cleans up when the program terminates.*

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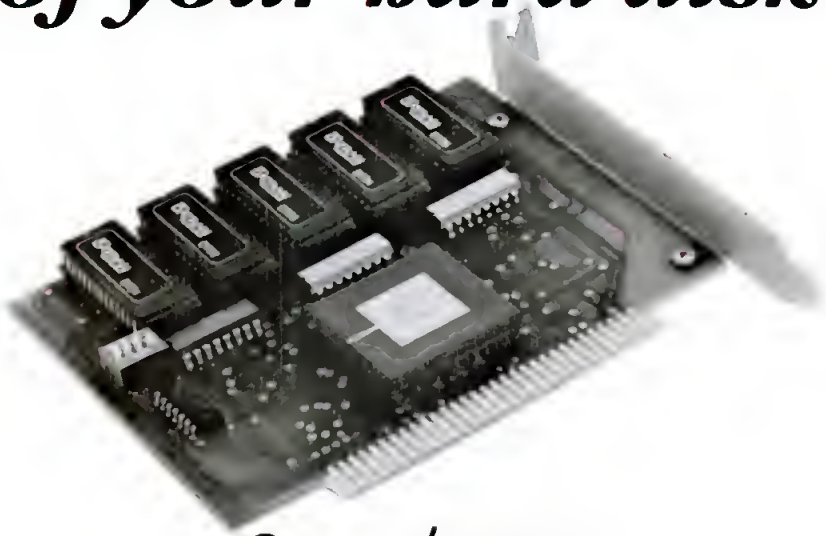
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```
/*------------------------------------------------------------------------
   PMHELLO1.C -- OS/2 PM "Hallo, world" Program -- Window Procedura #1
                 (c) 1988, Ziff Communications Company
                 PC Magazina * Charlas Petzold, 7/88
  ------------------------------------------------------------------------*/

#includa <os2.h>

MRESULT EXPENTRY ClientWndProc (HWND hwnd, USHORT msg, MPARAM mp1, MPARAM mp2)
     {
     HPS   hps ;
     RECTL rcl ;

     switch (msg)
          {
          case WM_PAINT:
               hps = WinBeginPaint (hwnd, NULL, NULL) ;

               WinQuaryWindowRect (hwnd, &rcl) ;
               WinDrawText (hps, -1, "Hallo, world", &rcl,
                            CLR_NEUTRAL, CLR_BACKGROUND,
                            DT_CENTER | DT_VCENTER | DT_ERASERECT) ;

               WinEndPaint (hps) ;
               raturn 0 ;
          }
     raturn WinDefWindowProc (hwnd, msg, mp1, mp2) ;
     }
```

Figure 4: *This window procedure processes only the WM_PAINT message. It obtains the dimensions of the window and displays "Hello, world" in the center.*

tute one such pair. WinInitialize must be called before any other Presentation Manager function, and WinTerminate should be called before the program ends.

WinCreatcMsgQueue and WinDestroyMsgQueue form a second pair. Any Presentation Manager program that creates a window (and almost all do so) must create a messagc queue for storing messages to that window. These messages usually represent user input from the keyboard and mouse.

Why doesn't the WinInitialize function itself create a message queue instead of requiring the program to create it explicitly? The explanation is simple—a Presentation Manager program can consist of several threads of execution. Some of these threads can have message queues, but others may not need them. A message queue is always associated with a particular thread and stores messages to windows in that thread. Only those threads that create windows need a message queue.

The third pair of functions is WinCreateStdWindow and WinDestroyWindow. The "standard window" is actually a collection of several windows, arranged in a normal configuration. These windows are the title bar window, the system menu window (to the left of the title bar), the minimize/maximize menu (to the right of the title bar), the sizing border window (around the outside), a client window (the large interior space where "Hello, world" appears), and the frame window, which is the "parent" window of all the others and holds the whole thing together. The WinDestroyWindow function destroys the frame window and all the child windows.

All the windows created by WinCreateStdWindow are based on various "window classes." Each window class is associated with a particular window procedure that is responsible both for painting the window and processing messages to it. For all the windows except the client window, the window procedures are internal to the Presentation Manager. The window procedure for the client window is in the PMHELLO1.C module (Figure 4) and is called ClientWndProc.

WinRegisterClass creates a window class for the client window using ClientWndProc as the window procedure. The window class is named "PMHello," which is the text string stored in the szClientClass variable (see Figure 3). This variable is also passed to WinCreateStdWindow to indicate the window class for the client window.

Finally, the WinGetMsg and WinDis-

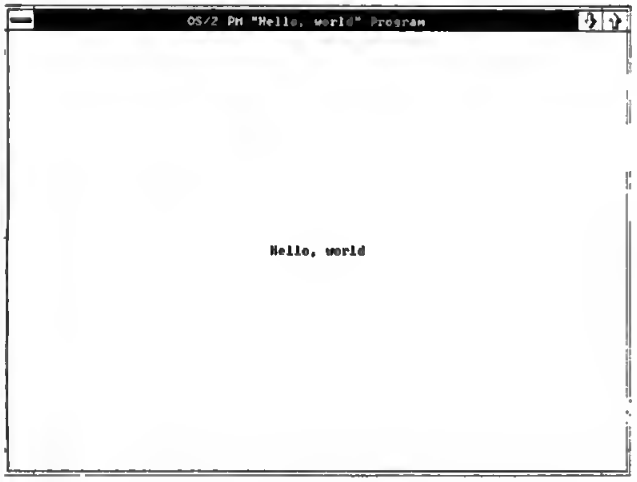


Figure 5: *The PMHELLO1.EXE program displays the "Hello, world" text in the center of its window.*



Figure 6: *PMHELLO3.EXE displays "Hello, world" using an outline font on a diagonal baseline.*

patchMsg functions constitute a fourth pair. WinGetMsg retrieves a message from the message queue, and WinDispatchMsg sends it to the window procedure associated with the window to which the message is addressed. The program stays in this loop until WinGetMsg returns a 0, which occurs when it retrieves a message called WM_QUIT from the message queue. This message is generated when you end the program from the system menu.

WHERE THE ACTION IS All the real action takes place in the window procedure. When WinGetMsg retrieves a message for the client window, WinDispatchMsg calls the client window procedure. This is the function ClientWndProc in the PMHELLO1.C listing in Figure 4. (The Presentation Manager can also call window procedures directly without first placing a message in the message queue.)

What a window procedure does with these messages determines how the window appears to the user on the screen and how it reacts to user input. Almost everything a Presentation Manager program does is a response to a message.

In the case of ClientWndProc in PMHELLO1, the window procedure ignores all messages except WM_PAINT. Any message a window procedure does not process must be passed to WinDefWindowProc for default processing.

The WM_PAINT message indicates that it is time for the window procedure to update the window. The window procedure receives a WM_PAINT message when the window is first created, whenever the window is resized, or when part of the window must be repaired after being obscured by another window.

While processing WM_PAINT, PMHELLO1 calls another pair of overhead functions: WinBeginPaint and WinEndPaint. The WinBeginPaint function obtains a handle to a presentation space, which is needed for all functions that display output to the window.

The 12 functions discussed so far are overhead that is found in virtually every Presentation Manager program. Now we come to the two functions—WinQueryWindowRect and WinDrawText—that ac-

```
/*--------------------------------------------------------------------
   PMHELLO2.C -- OS/2 PM "Hello, world" Program -- Window Procedure #2
                 (c) 1988, Ziff Communications Company
                 PC Magazine * Charles Petzold, 7/88
  --------------------------------------------------------------------*/

#define INCL_GPI
#include <os2.h>

MRESULT EXPENTRY ClientWndProc (HWND hwnd, USHORT msg, MPARAM mp1, MPARAM mp2)
     {
     static CHAR  szText[] = "Hello, world" ;
     static LONG  lLen = sizeof szText - 1 ;
     static SHORT cxClient, cyClient ;
     HPS          hps ;
     POINTL       ptl, aptlTextBox[TXTBOX_COUNT] ;

     switch (msg)
          {
          case WM_SIZE:
               cxClient = SHORT1FROMMP (mp2) ;
               cyClient = SHORT2FROMMP (mp2) ;
               return 0 ;

          case WM_PAINT:
               hps = WinBeginPaint (hwnd, NULL, NULL) ;
               GpiErase (hps) ;

               GpiQueryTextBox (hps, lLen, szText, TXTBOX_COUNT, aptlTextBox) ;

               ptl.x = (cxClient - (aptlTextBox[TXTBOX_BOTTOMRIGHT].x -
                                    aptlTextBox[TXTBOX_BOTTOMLEFT].x)) / 2 ;
               ptl.y = (cyClient - (aptlTextBox[TXTBOX_TOPLEFT].y -
                                    aptlTextBox[TXTBOX_BOTTOMLEFT].y)) / 2 ;

               GpiCharStringAt (hps, &ptl, lLen, szText) ;

               WinEndPaint (hps) ;
               return 0 ;
          }
     return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
     }
```

Figure 7: *This PMHELLO2.C window procedure shows an alternative approach to displaying "Hello, world" in the center of the client window.*

```
/*--------------------------------------------------------------------
   PMHELLO3.C -- OS/2 PM "Hello, world" Program -- Window Procedure #3
                 (c) 1988, Ziff Communications Company
                 PC Magazine * Charles Petzold, 7/88
  --------------------------------------------------------------------*/

#define INCL_GPI
#include <os2.h>

MRESULT EXPENTRY ClientWndProc (HWND hwnd, USHORT msg, MPARAM mp1, MPARAM mp2)
     {
     static CHAR  szText[] = "Hello, world" ;
     static LONG  lLen = sizeof szText - 1 ;
     static SHORT cxClient, cyClient ;
     HPS          hps ;
     GRADIENTL    gradl ;
     POINTL       ptl, aptlTextBox[TXTBOX_COUNT] ;

     switch (msg)
          {
          case WM_SIZE:
               cxClient = SHORT1FROMMP (mp2) ;
               cyClient = SHORT2FROMMP (mp2) ;
               return 0 ;

          case WM_PAINT:
               hps = WinBeginPaint (hwnd, NULL, NULL) ;
               GpiErase (hps) ;

               gradl.x = cxClient ;
               gradl.y = cyClient ;
               GpiSetCharAngle (hps, &gradl) ;
                                                        (continues)
```

Figure 8: *Only slightly longer than PMHELLO2.C, the PMHELLO3.C window procedure displays the text on a diagonal baseline.*



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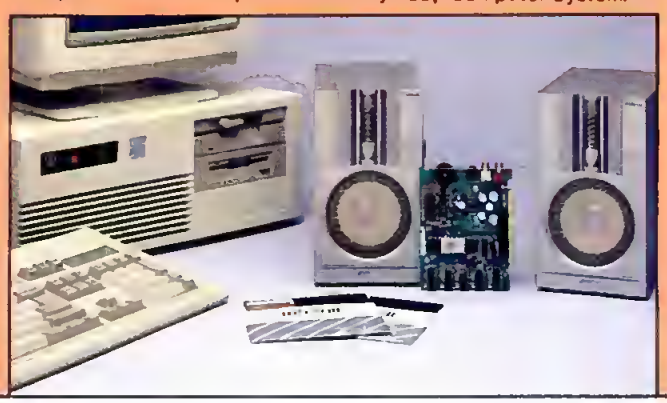
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```
            GpiSetCharMode (hps, CM_MODE3) ;

            GpiQueryTextBox (hps, lLen, szText, TXTBOX_COUNT, aptlTextBox) ;

            ptl.x = (cxClient - (aptlTextaox[TXTAOX_BOTTOMRIGHT].x -
                                 aptlTextaox[TXTBOX_TOPLEFT].x)) / 2 ;
            ptl.y = (cyClient - (aptlTextBox[TXTBOX_TOPRIGHT].y -
                                 aptlTextBox[TXTBOX_BOTTOMLEFT].y)) / 2 ;

            GpiCharStringAt (hps, &ptl, lLen, szText) ;

            WinEndPaint (hps) ;
            return 0 ;
        }
    return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
    }
```

(Figure 8 ends)

```
;-----------------------------------
; PMHELLO.DEF module definition file
;-----------------------------------

NAME            WINDOWAPI

DESCRIPTION     'PM "Hello World" Program (c) 1988, Ziff Communications Co.'
PROTMODE
STACKSIZE       8192
EXPORTS         ClientWndProc
```

Figure 9: *PMHELLO.DEF contains information that LINK uses when constructing the .EXE files.*

```
#--------------------
# PMHELLO make file
#--------------------

pmhello.obj : pmhello.c
     cl -c -G2sw -W3 pmhello.c

pmhello1.obj : pmhello1.c
     cl -c -G2sw -W3 pmhello1.c

pmhello1.exe : pmhello.obj pmhello1.obj pmhello.def
     link pmhello1 pmhello, /align:16, NUL, os2, pmhello

pmhello2.obj : pmhello2.c
     cl -c -G2sw -W3 pmhello2.c

pmhello2.exe : pmhello.obj pmhello2.obj pmhello.def
     link pmhello2 pmhello, /align:16, NUL, os2, pmhello

pmhello3.obj : pmhello3.c
     cl -c -G2sw -W3 pmhello3.c

pmhello3.exe : pmhello.obj pmhello3.obj pmhello.def
     link pmhello3 pmhello, /align:16, NUL, os2, pmhello
```

Figure 10: *The PMHELLO Make file automates the creation of the PMHELLO1.EXE, PMHELLO2.EXE, and PMHELLO3.EXE files.*

tually accomplish what we set out to do.

The WinQueryWindowRect function obtains the current dimensions of the window and stores them in a RECTL structure. The RECTL structure describes a rectangle and has four fields, named xLeft, yBottom, xRight, and yTop. The WinDrawText function uses this structure in displaying text. The DT_CENTER and DT_VCENTER parameters indicate that the text is to appear in the center of that rectangle.

A TALE OF TWO FUNCTIONS Most of the functions in the Presentation Manager begin with either a Win or Gpi prefix. The Win prefix indicates a windowing and user interface facilities function of the Presentation Manager; Gpi refers to the Graphics Programming Interface. Most output functions are Gpi functions. WinDrawText is one of the few exceptions.

WinDrawText is a high-level output function that does the work of a couple of Gpi functions. It is certainly convenient for some purposes (for example, the window procedure for the title bar probably draws its text using WinDrawText), but the use of a rectangle for positioning text is not suitable for most text-drawing jobs.

A Presentation Manager program that displays text in its window most commonly uses the GpiCharStringAt function. This function displays text beginning at a specific coordinate within the window. (By default, the coordinates are in units of pixels relative to the lower-left corner of the window.)

The general syntax for the GpiCharStringAt function is

```
GpiCharStringAt (hps, &ptl, lLength, acText) ;
```

The last parameter is the text you want to display, stored as an array of characters. The lLength parameter is the length of the string. (GpiCharStringAt does not recognize 0-terminated strings.) The second parameter is a pointer to a POINTL structure. This structure contains two fields, named x and y. The point you specify in the POINTL structure corresponds to the baseline of the left side of the first character.

If we want to center the text in the window, we must figure how much space the text requires. By default, the Presentation Manager uses a font called the "system font." This is the monospace font (that is, all the characters have the same width) that is used for text in title bars, menus, and dialog boxes.

The size of the characters in the system font is dependent on the video display adapter on which the Presentation Manager is running. This means that a program cannot hard-code or guess at system font dimensions. It must obtain that information from the Presentation Manager.

The approach taken here uses the GpiQueryTextBox function. This function as-



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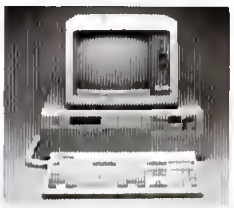
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sumes that a text string is to be displayed at the point (0,0). It returns an array of POINTL structures that provide the coordinates of the four corners of the rectangle in which the text would be displayed. The PMHELLO2.C module shown in Figure 7 illustrates how this is done. The PMHELLO2.EXE program consists of the `main` function in PMHELLO.C and ClientWndProc in PMHELLO2.C.

In PMHELLO2.C, the window procedure obtains the size of the client window by processing the WM_SIZE message. The window procedure receives a WM_SIZE message when the window is first displayed and whenever the size changes. The size is encoded in the mp2 message parameter. The SHORT1FROMMP and SHORT2FROMMP macros help extract the horizontal and vertical dimensions. These dimensions are stored in the static variables cxClient and cyClient.

During the WM_PAINT message, the program obtains the dimensions of the text string, calculates a starting position for the text using this information, and displays it using GpiCharStringAt.

NOW FOR THE CHALLENGE We've seen that Presentation Manager programs require a little more overhead than Teletype-mode or full-screen character-mode programs. But this overhead merely gets the program running. Most other tasks require much less code.

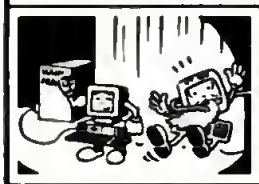
For example, suppose someone complains to you about the 40-line size of our first Presentation Manager "Hello, world" program: he'd much prefer the simplicity of the original HELLO.C program shown in Figure 1. Ask him "How much additional code would you need in HELLO.C to display the text on a diagonal baseline?" The answer will probably be "Why would I want to do that?"

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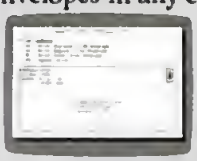
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line by adding one variable and four lines of code to the PMHELLO2.C file and modifying two other statements. The result, PMHELLO3.C, is in Figure 8.

Once again, PMHELLO3.EXE uses the `main` function in PMHELLO.C. Figure 6 shows PMHELLO3.EXE running under the Presentation Manager.

During the WM_PAINT message, PMHELLO3 calls GpiSetCharAngle. This function uses a structure called GRADIENTL, which has two fields, named x and y. After you call GpiSetCharAngle, the Presentation Manager displays text on a baseline running from the point (0,0) to the point specified in the GRADIENTL structure.

By default, the Presentation Manager uses bitmap fonts (also called image fonts) to display text. These are stored as a simple block of 0's and 1's. Characters based on these fonts can be displayed very quickly. However, a bit-mapped font can't be rotated by less than 90-degree increments.

When the Presentation Manager must display text at an angle, then, it switches to an outline font. An outline font is stored as a series of straight lines and curves. The Presentation Manager must draw the outline and fill in the interior. Consequently, performance suffers.

The trade-off between performance and appearance is resolved with the GpiSetCharMode function. It takes three possible parameters, CM_MODE1 (the default), CM_MODE2, and CM_MODE3. Mode 1 indicates that you want the highest performance. Regardless of the character angle you set, the Presentation Manager will display the text using a bitmap font on a horizontal baseline. With Mode 2, the individual characters are displayed at the correct positions, but the characters themselves are not rotated. The Presentation Manager continues to use a bitmap font. With Mode 3, you get an outline font that does exactly what you want.

THE MECHANICS If you have installed Microsoft's big OS/2 Software Development Kit, you can compile and run the three PMHELLO programs yourself. You'll need the PMHELLO.DEF module definition file in Figure 9 and the PMHELLO Make file in Figure 10.

To create PMHELLO1.EXE, PMHELLO2.EXE, and PMHELLO3.EXE, you execute

```
MAKE PMHELLO
```

If you don't have the OS/2 Software Development Kit, you'll have to be patient just a little longer. I'm told that Microsoft will have a lower-cost Presentation Manager Programmer's Toolkit available before the end of the year. PC

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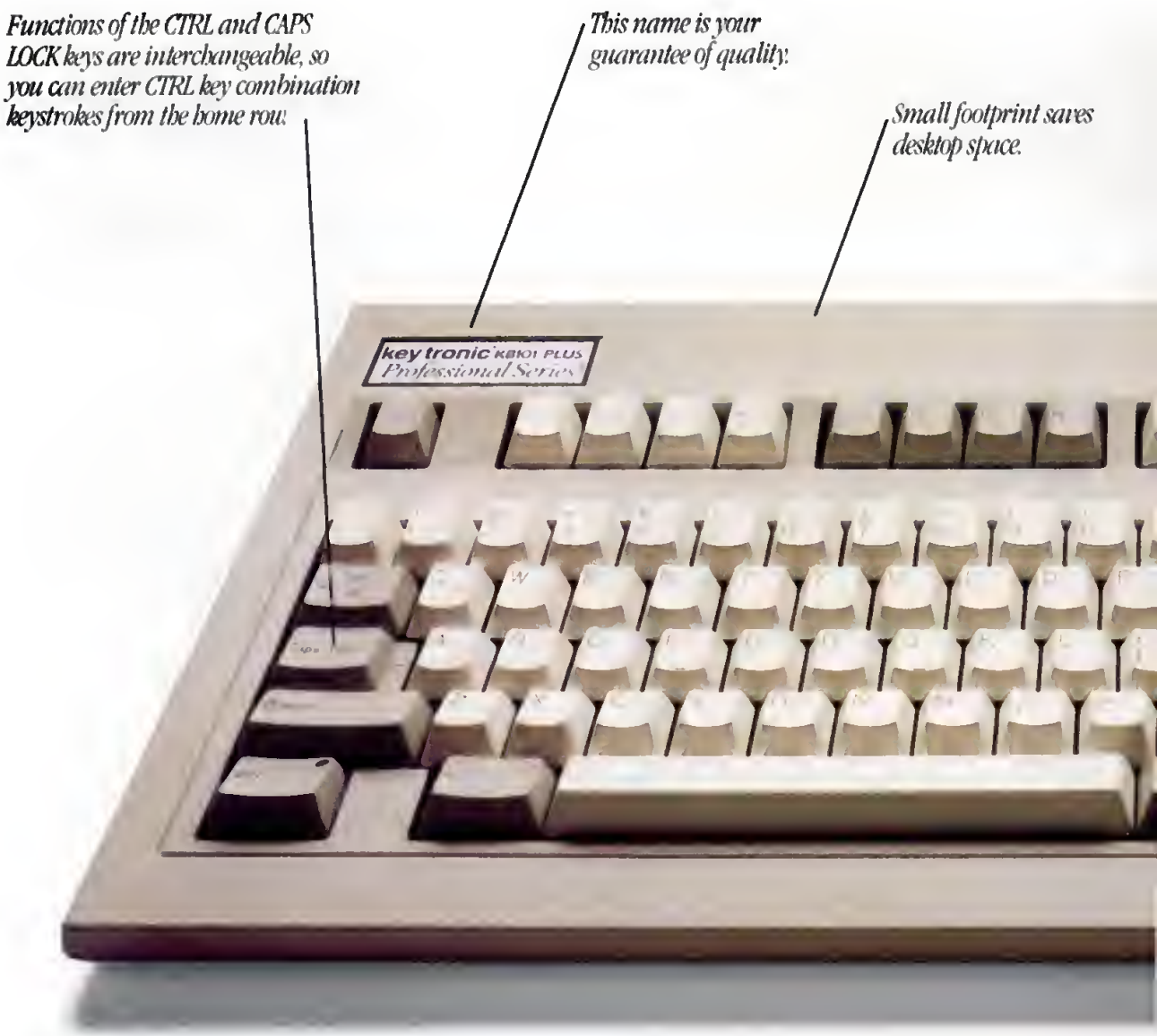
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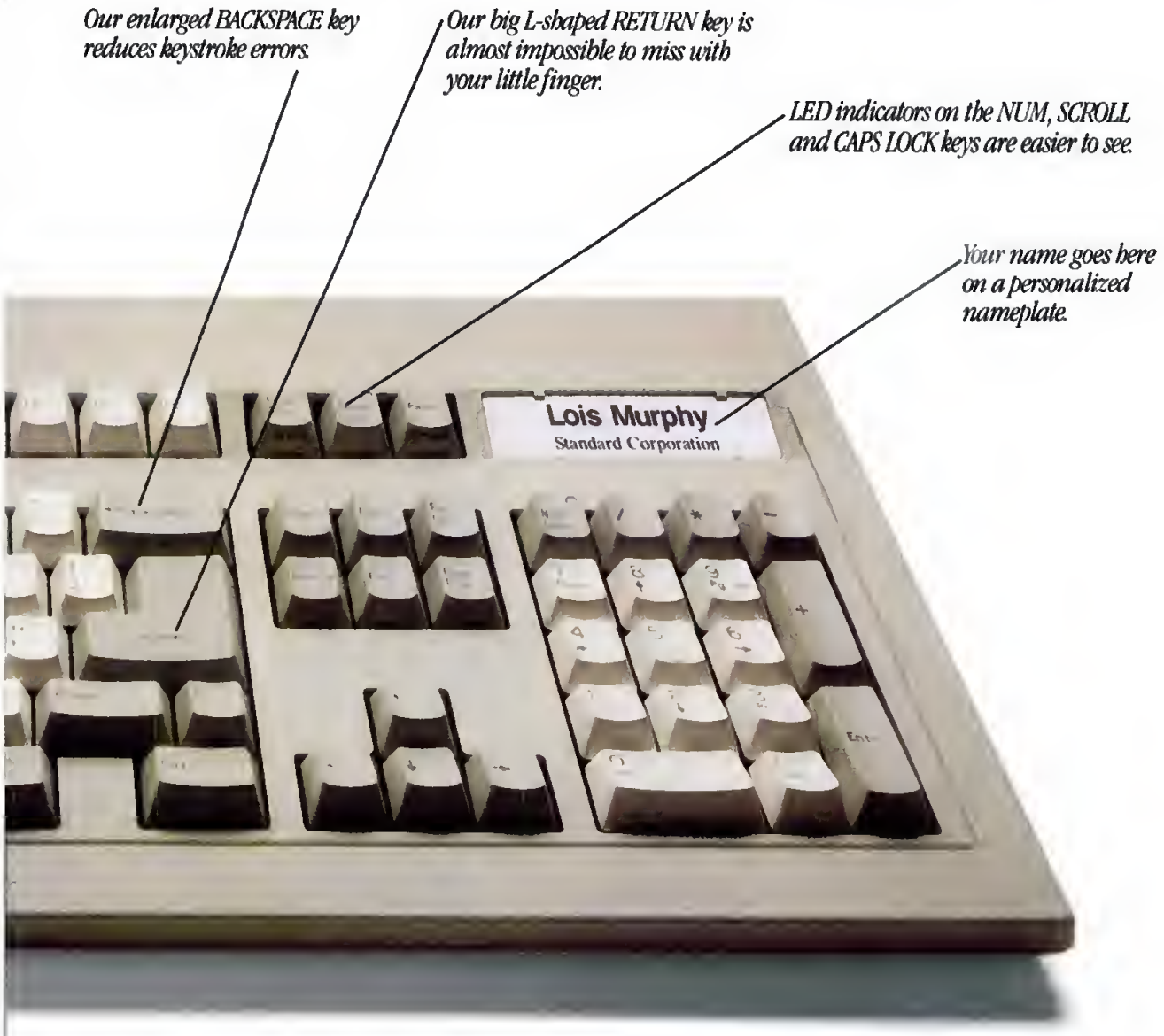
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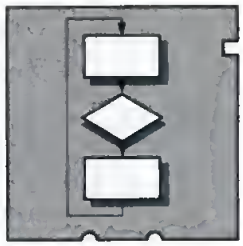
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ASSEMBLY LANGUAGE STRING ROUTINES



Here are four assembler routines for comparing, searching, and validating strings that are similar to some C functions. You'll want to add these to your Power Programming library.

In my previous column I talked briefly about the C runtime library string functions and showed some simple examples of string handling in assembly code. In this issue I'll present the first of several "packages" of assembly code string routines with more-sophisticated capabilities. The package in this column has four procedures to compare, search, and validate strings. Subsequent packages will provide case-insensitive processing and routines to concatenate and extract strings.

ASSEMBLY STRING PACKAGE #1

The listing STRINGS1.ASM, shown in Figure 1, is the source code for our first string package. It contains four public routines: STRCMP, STRNDX, STRSPN, and STRBRK. To some extent the names for these general-purpose routines were picked with an eye on those used in the C runtime library. However, the routines' arguments and results are oriented toward the needs of an assembly language programmer, so they may not be exactly analogous to any apparent C counterparts.

STRCMP is a general-purpose string comparison routine with the following parameters:

```
DS:SI = string1 address
BX    = string1 length
ES:DI = string2 address
DX    = string2 length
```

The result of the comparison is determined by the first nonequal character in the strings. If the first different character in

```
;-----------------------------------------------------------------------
; STRINGS1.ASM --- MASM String Package #1
;
; Copyright (c) 1988, Siff Communications Co.
; PC Magazine * Ray Duncan * November 15, 1988
;-----------------------------------------------------------------------
_TEXT   segment word public 'CODE'
        assume  cs:_TEXT

;-----------------------------------------------------------------------
; STRCMP: General purpose string comparison routine
;
; Call with:    DS:SI = address of string1
;               BX    = length of string1
;               ES:DI = address of string2
;               DX    = length of string2
;
; Returns:      Z     = True  if strings are equal
;               or
;               C     = False if strings are not equal, and
;               S     = True  if string1 < string2
;               S     = False if string1 > string2
;-----------------------------------------------------------------------
        public  strcmp
strcmp  proc    near

        mov     cs,dx           ; set length to compare

        cmp     bs,dx           ; use shorter of two lengths
        ja      scmp1           ; jump if string1 longer

        mov     cx,bs           ; string1 is shorter

scmp1:  repz        cmpsb               ; now compare strings
        je      scmp2           ; jump, strings equal so far

        ret                     ; return S=F, strings not equal

scmp2:  sub     bs,ds           ; compare original string lengths
        ret                     ; return with S and C flags set

strcmp  endp

;-----------------------------------------------------------------------
; STRNDX: General purpose string search routine
;
; Call with:    DS:SI = pattern address
;               BX    = pattern length
;               ES:DI = address of string to be searched
;               DX    = length of string to be searched
;
; Returns:      CY    = True if no match
;               or
;               CY    = False if match, and
;               ES:DI = pointer to match for pattern
;                       string within searched string
;-----------------------------------------------------------------------
        public  strndx
strndx  proc    near

        mov     bp,si           ; save pattern offset
        dec     bx              ; decr. pattern length by one
        cld

sndx1:  mov     si,bp           ; AL := first char of pattern
        lodsb
        mov     cx,dx           ; remaining searched string length
        repne       scasb               ; look for match on first char.

        jns     sndx3           ; searched string exhausted, exit

        mov     ds,cx           ; save new string length
        mov     cs,bs           ; get pattern length - 1
        repz        cmpsb               ; compare remainder of strings

        je      sndx2           ; everything matched

        add     di,cs           ; no match, restore string addr
        sub     di,bx           ; advanced by one char.

        cmp     dx,bs           ; searched string exhausted?
        ja      sndx1           ; some string left, try again
        jmp     sndx3           ; no match, jump to return

sndx2:  sub     di,bx           ; match found, let
        dec     di              ; ES:DI = matched string addr.
        clc                     ; and return CY=False
        ret

sndx3:  stc                     ; no match, return CY=True
        ret
```

(continues)

Figure 1: *STRINGS1.ASM contains the source code for the STRCMP, STRNDX, STRSPN, and STRBRK routines.*

■ POWER PROGRAMMING

```
strndx  sndp

;-------------------------------------------------------------------
; STRSPN: General purpose string validation routine
;
; Call with:    DS:SI = text string to be validated
;               BX    = length of text string
;               ES:DI = validation string
;               DX    = length of validation string
;
; Returns:      CY    = False if text string valid
;               or
;               CY    = True if text string invalid, and
;               DS:SI = pointer to invalid character
;                       within text string
;-------------------------------------------------------------------
        public  strspn
strspn  proc    near

        mov     cx,bx           ; CX = length of text string
        jcxz    sspn5           ; exit if no text string

        or      dx,dx           ; exit if no validation string
        je      sspn3

sspn1:  lodsb                   ; get next text string char.
        xor     bx,bx           ; BX is validation string index

sspn2:  cmp     al,es:[bx+di]   ; compare to validation string
        je      sspn4           ; this character is OK

        inc     bx              ; bump validation string addr.
        cmp     bx,dx           ; end of validation string yet?
        jne     sspn2           ; no, check next position

        dec     si              ; yes, point to bad character

sspn3:  stc                     ; return CY flag true and
        ret                     ; DS:SI = bad character

sspn4:  loop    sspn1           ; count text string characters
                                ; and check the next one

sspn5:  clc                     ; all characters were OK
        ret                     ; return CY flag false

strspn  endp
```

```
;-------------------------------------------------------------------
; STRBRK: General purpose character set search routine
;
; Call with:    DS:SI = text string to search
;               BX    = length of text string
;               ES:DI = character list to search for
;               DX    = length of character list
;
; Returns:      CY    = False if no matching characters
;                       in text string
;               or
;               CY    = True if matching character found
;                       in text string, and
;               DS:SI = matched character within text string
;-------------------------------------------------------------------
        public  strbrk
strbrk  proc    near

        or      bx,bx           ; check text length
        js      sbrk3           ; exit if no text string

        or      dx,dx           ; check list length
        je      sbrk3           ; exit if no list

sbrk1:  lodsb                   ; get next text string char.
        mov     cx,dx           ; CX = list length
        repnz   scasb           ;      scan the character list
        jns     sbrk2           ; jump if no chars. matched

        dec     si              ; point to matching char.
        stc                     ; return CY flag True
        ret                     ; and DS:SI = matched char.

sbrk2:  sub     di,dx           ; reset char. list address
        dec     bx              ; count list characters
        jnz     sbrk1           ; loop, not end of list

sbrk3:  clc                     ; no matching characters,
        ret                     ; return CY flag false

strbrk  endp

_TEXT   ends

        end
```

(Figure 1 ends)

string1 is less than the character in string2, then string1 is less than string2. If the strings are of different lengths but contain identical characters up to the end of the shorter string, then the shorter string is considered less than the longer string. For example,

```
"ABC" is less than "ABD"
"ABC" is less than "ABCD"
```

STRCMP returns the results of the string comparison in the CPU's Zero and Sign flags. This means you can call STRCMP and then follow it with a signed conditional branch, just as you could branch on the comparison of two registers.

```
call strcmp     ; compare strings
jl   label1     ; jump if string1
                ; less than string2
```

STRNDX is a general-purpose string search routine. Its arguments are

```
DS:SI = pattern string address
BX    = pattern string length
ES:DI = text string address
DX    = text string length
```

Both the pattern and text strings may be any length (up to an entire segment). STRNDX searches the text string for the first occurrence of the complete pattern string, so the pattern string should always be shorter than the text string.

If no match is found, STRNDX returns the Carry flag true (1). If there is a match, STRNDX returns the Carry flag false (0) and ES:DI pointing to the first character of the matching sequence within the string being searched. Thus, calls to STRNDX typically take the following form:

```
call strndx     ; search string2
jc   label1     ; jump if no match
```

■ STRNDX searches the text string for the first occurrence of the complete pattern string, so the pattern string should always be shorter than the text string.

STRSPN is a general-purpose string validation routine. It is called with the arguments

```
DS:SI = text string address
BX    = text string length
ES:DI = validation string address
DX    = validation string length
```

STRSPN tests each character of the text string against the validation string. If every character of the text string is a member of the validation string, STRSPN returns the Carry flag false (0). If one or more characters in the text string are not found in the validation string, STRSPN returns the Carry flag true (1) and DS:SI points to the invalid character within the text string.

STRSPN is best used for screening keyboard input. For example, if the user enters a string that is supposed to represent a decimal integer, you can quickly check his entry by using the address and length of the keyboard input as the text string, along with the address and length of the following validation string:

```
db    '0123456789-+'
```

If the input string passes the screening with STRSPN, you can then pass this string to one of the conversion routines that was presented previously in Power Programming (such as ATOI.ASM or ATOL.

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```
;-------------------------------------------------------------------------
; TRYSTR.ASM --- demo of MASM string package
; PC Magazine * Ray Duncan * November 15, 1988
;-------------------------------------------------------------------------
cr      equ     0dh             ; ASCII carriage return
lf      equ     0ah             ; ASCII line feed

stdio   equ     0               ; standard input handle
stdout  equ     1               ; standard output handle
stderr  equ     2               ; standard error handle

DGROUP  group   _DATA

_DATA   segment word public 'DATA'

str1    db      80 dup (0)      ; string 1 buffer
str2    db      80 dup (0)      ; string 2 buffer

s1len   dw      ?               ; string 1 length
s2len   dw      ?               ; string 2 length

msg1    db      cr,lf,lf
        db      'Enter string 1:  '
msg1_len equ $-msg1

msg2    db      cr,lf
        db      'Enter string 2:  '
msg2_len equ $-msg2

msg3    db      cr,lf
        db      'String 1 at: '
msg3a   db      '????H'
        db      cr,lf
        db      'String 2 at: '
msg3b   db      '????H'
        db      cr,lf,lf
        db      'STRCMP: Z='
msg3c   db      '? S='
msg3d   db      '?'
        db      cr,lf
        db      'STRNDX: CY='
msg3e   db      '? DI='
msg3f   db      '????H'
        db      cr,lf
        db      'STRSPN: CY='
msg3g   db      '? SI='
msg3h   db      '????H'
        db      cr,lf
        db      'STRBRK: CY='
msg3i   db      '? SI='
msg3j   db      '????H'
msg3_len equ $-msg3

_DATA   ends


_TEXT   segment word public 'CODE'

        extrn   strcmp:near
        extrn   strndx:near
        extrn   strspn:near
        extrn   strbrk:near
        extrn   itoh:near
        assume  cs:_TEXT,ds:DGROUP

main    proc    near

        mov     ax,_DATA        ; make our data segment
        mov     ds,ax           ; addressable...
        mov     es,ax

        mov     ax,offset str1  ; format string 1
        mov     bx,offset msg3a ; buffer address
        call    itoh            ; for output

        mov     ax,offset str2  ; format string 2
        mov     bx,offset msg3b ; buffer address
        call    itoh            ; for output

main1:                          ; display prompt for string 1...
        mov     dx,offset DGROUP:msg1 ; address of message
        mov     cx,msg1_len     ; length of message
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS

                                ; get first string...
                                ; address of buffer
        mov     dx,offset DGROUP:str1
        mov     cx,64           ; maximum entry length
        mov     bx,stdin        ; standard input handle
        mov     ah,3fh          ; function 3fh = read
        int     21h             ; transfer to MS-DOS

        sub     ax,2            ; anything entered?
        mov     s1len,ax        ; save string length

        jns     main2           ; jump if something entered

        mov     ax,4c00h        ; exit if empty line
        int     21h             ; transfer to MS-DOS

main2:                          ; display prompt for string 2...
        mov     dx,offset DGROUP:msg2  ; address of message
        mov     cx,msg2_len     ; length of message
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS

                                ; get second string...
        mov     dx,offset DGROUP:str2   ; address of buffer
        mov     cx,64           ; maximum entry length
        mov     bx,stdio        ; standard input handle
        mov     ah,3fh          ; function 3fh = read
        int     21h             ; transfer to MS-DOS

        sub     ax,2            ; save string length
        mov     s2len,ax

        mov     si,offset str1  ; compare the strings
        mov     bx,s1len
        mov     dl,offset str2
        mov     dx,s2len
        call    strcmp

        call    sflag           ; format S and Z
        mov     msg3c,al        ; flags for output
        call    zflag
        mov     msg3d,al

        mov     si,offset str1  ; search string 2
        mov     bx,s1len        ; for string 1
        mov     di,offset str2
        mov     dx,s2len
        call    strndx

        call    cflag           ; format CY flag
        mov     msg3e,al        ; for output

        mov     ax,di           ; format string 2
        mov     bx,offset msg3f ; pointer for output
        call    itoh

        mov     si,offset str1  ; validate string 1
        mov     bx,s1len        ; using string 2
        mov     di,offset str2
        mov     dx,s2len
        call    strspn

        call    cflag           ; format CY flag
        mov     msg3g,al        ; for output

        mov     ax,si           ; format string 1
        mov     bx,offset msg3h ; pointer for output
        call    itoh

        mov     si,offset str1  ; find first char
        mov     bx,s1len        ; in string 1 that
        mov     di,offset str2  ; is in string 2
        mov     dx,s2len
        call    strbrk

        call    cflag           ; format CY flag
        mov     msg3i,al        ; for output

        mov     ax,si           ; format string 1
        mov     bx,offset msg3j ; pointer for output
        call    itoh

                                ; display results...
        mov     dx,offset DGROUP:msg3   ; address of message
        mov     cx,msg3_len     ; length of message
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; function 40h = write
        int     21h             ; transfer to MS-DOS

        jmp     main1           ; get more strings

main    endp


zflag   proc    near

        mov     al,'F'
        jcz     zflag1
        mov     al,'T'
zflag1: ret

zflag   endp


sflag   proc    near
        mov     al,'F'
        jcs     sflag1
        mov     al,'T'
sflag1: ret

sflag   endp


cflag   proc    near

        mov     al,'F'
        jcc     cflag1
        mov     al,'T'
cflag1: ret

cflag   endp

_TEXT   ends


STACK   segment para stack 'STACK'

        db      128 dup (?)
STACK   ends

        end     main
```

Figure 2: *TRYSTR.ASM provides a demonstration of the assembler string routines in action.*

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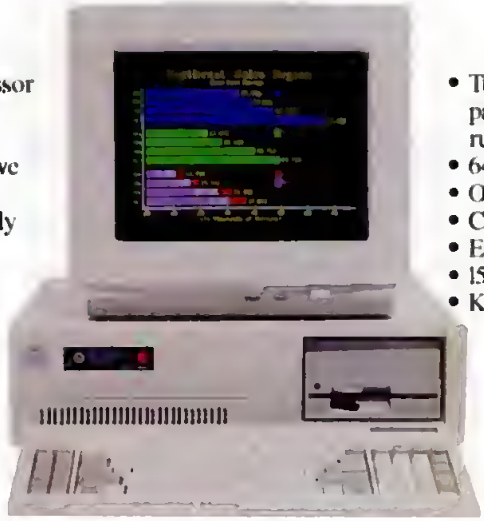


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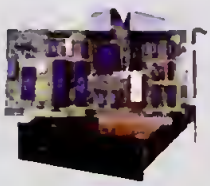
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CIRCLE 161 ON READER SERVICE CARD

```
;-----------------------------------------------------------------------
; ITOH ---  converts 16-bit unsigned integer
;           into a "hexadecimal" ASCII string.
;
; Copyright (c) 1988, Ziff Communications Co.
; PC Magazine * Ray Duncan * November 15, 1988
;
; Call with     AX    = value to convert
;               DS:BX = address to store 4-character string
;
; Returns       AX, BX destroyed, other registers preserved
;-----------------------------------------------------------------------
_TEXT   segment word public 'CODE'

        assume  cs:_TEXT

        public  itoh
itoh    proc    near

        push    cx              ; save registers
        push    dx

        mov     dx,4            ; initialize char. counter
itoh1:
        mov     cx,4            ; isolate next four bits
        rol     ax,cl
        mov     cx,ax
        and     cx,0fh
        add     cx,'0'          ; convert to ASCII
        cmp     cx,'9'          ; is it 0-9?
        jbe     itoh2           ; yes, jump
        add     cx,'A'-'9'-1    ; add correction for A-F
itoh2:                          ; store this character
        mov     [bx],cl
        inc     bx              ; bump string pointer

        dec     dx              ; count characters converted
        jnz     itoh1           ; loop, not four yet

        pop     dx              ; restore registers
        pop     cx
        ret                     ; back to caller

itoh    endp

_TEXT   ends

        end
```

Figure 3: *ITOH.ASM is used in creating TRYSTR.EXE.*

ASM) and turn it into a binary value.

STRBRK is a general-purpose routine for finding one character in a set within a text string. Its parameters are

```
DS:SI = text string address
BX    = text string length
ES:DI = character list address
DX    = character list length
```

STRBRK compares each position of the text string, in order, against every member of the character list. If STRBRK finds a match in the character list, it returns the Carry flag true (1) and DS:SI pointing to the character within the text string. If every character in the text string is not found in the character list, STRBRK returns the carry flag false (0).

The best application of STRBRK is in searching for delimiters. For instance, suppose that the user has entered a string consisting of several fields and that the program's instructions have told him that he can separate fields with spaces, commas, or dashes (hyphens). You can find the end of the first field by passing STRBRK the address and length of his keyboard input as the text string, and the address and length of the following character list:

```
db    20h,',','-'
```

Upon return from STRBRK, to find the end of the following field you would simply increment SI and call STRBRK again. Of course, the last field must be handled as a special case where you include the code for a carriage return (0Dh) in the character list.

STRSPN's and STRBRK's handling of zero-length parameter strings differ in a subtle way. If STRSPN is supplied a text string of zero length, it always returns the Carry flag false (0) to indicate that all members of the text string were valid. If it is given a text string containing at least one character, but a zero-length validation string, then STRSPN always returns the Carry flag true (1) to indicate that the text string was invalid. STRBRK, on the other hand, always returns the Carry flag false (0) if either the text string or character list has zero length. If you think about this for a while, you'll see that it makes sense.

■ STRBRK is a general-purpose routine for finding one character in a set within a text string.

INTERACTIVE DEMONSTRATION

The best way to learn how these string routines work is to try them out for yourself (and you can even trace through them with CodeView, if you like). To facilitate this

```
strings1.obj : strings1.asm
  masm /Zi strings1;

itoh.obj : itoh.asm
  masm /Zi itoh;

trystr.obj : trystr.asm
  masm /Zi trystr;

trystr.exe : trystr.obj strings1.obj itoh.obj
  link /CO trystr+strings1+itoh;
```

Figure 4: *The "Make" file for creating the TRYSTR.EXE demonstration program.*

```
C>trystr

Enter string 1:  Program  <Enter>

Enter string 2:  Power Programming  <Enter>

String 1 at: 0000H
String 2 at: 0050H

STRCMP: E=F E=F
STRNDX: CY=F DI=0056H
STRSPN: CY=F SI=0007H
STRBRK: CY=T SI=0000H

Enter string 1:  <Enter>

C>
```

Figure 5: *A sample session using the program TRYSTR.EXE.*

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CIRCLE 128 ON READER SERVICE CARD

exercise, the program TRYSTR.EXE is an interactive demonstration program that first allows you to enter two strings, next feeds them to STRCMP, STRNDX, STRSPN, and then STRBRK, and then displays the results.

In order to build TRYSTR.EXE, you need the following files: STRINGS1.ASM, TRYSTR.ASM, and ITOH.ASM, shown in Figures 1, 2, and 3, respectively. Put all three files in the same directory and enter the following commands to assemble and link them:

■ The displayed values for registers SI or DI may or may not be meaningful, depending on the Carry flag's value.

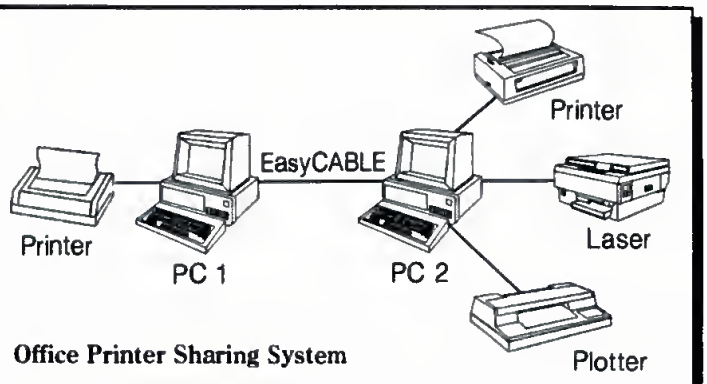
```
MASM /Zi STRINGS1;
MASM /Zi TRYSTR;
MASM /Zi ITOH;
LINK /CO TRYSTR+STRINGS1+ITOH;
```

If you don't want to trace through the demonstration program with CodeView, you can omit the /Zi and /CO switches. If you prefer to automate the process of creating TRYSTR.EXE, you can use the "Make" file in Figure 4.

A sample session with TRYSTR.EXE is shown in Figure 5. The four string routines have quite different uses. Concentrate on one at a time and temporarily ignore the results returned by the other three. Remember that the displayed values for registers SI or DI may or may not be meaningful, depending on the value of the Carry flag. To terminate the demonstration program, press Enter alone in response to the "Enter string 1" prompt.

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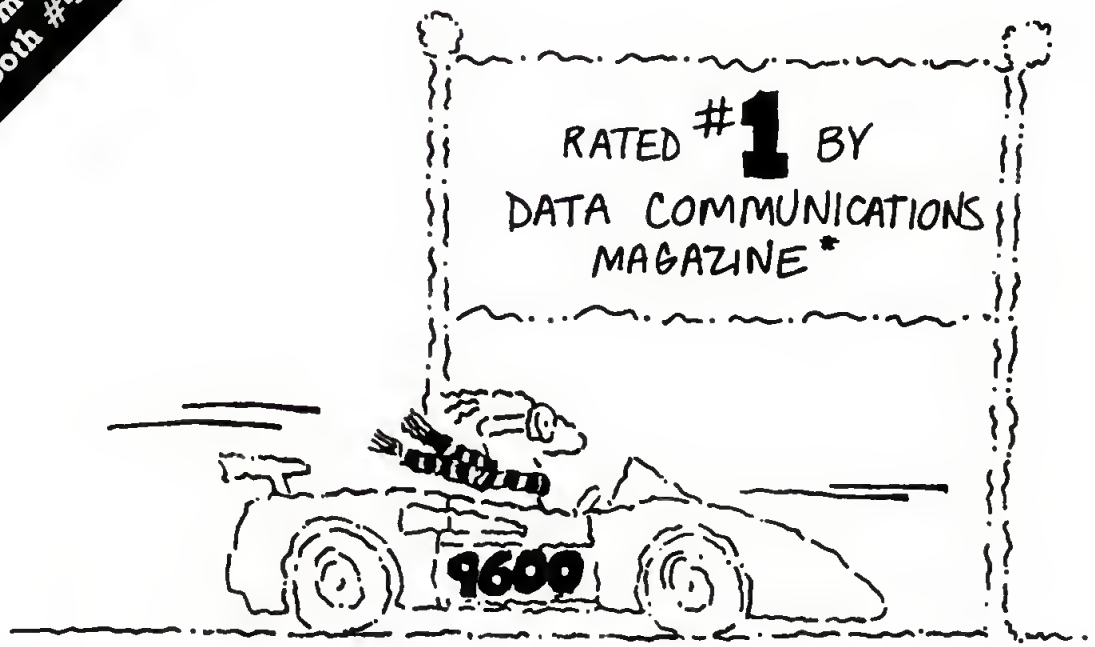
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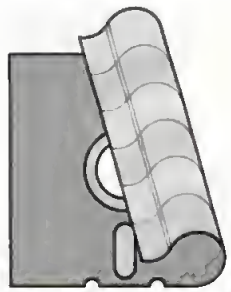
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CIRCLE 745 ON READER SERVICE CARD

■ DOUGLAS COBB AND STEVEN COBB

SPREADSHEET CLINIC



In a previous issue, we challenged our readers to develop a formula to calculate the annual interest rate for a loan. Here are the best solutions.

At the end of the letter entitled "Finding the term of a loan" (Spreadsheet Clinic, May 31, 1988), K. M. Gunsteens stated that he was unable to develop a formula that calculated the annual interest rate for a loan, given the amount of the loan, the amount of each periodic payment, and the number of periodic payments.

In our response to Mr. Gunsteens's letter, we asked you, our readers, to devise such a formula. The response to this challenge was so tremendous that we decided to devote this issue's column to presenting the best of the responses to the "Gunsteens Challenge."

All of the solutions in this column assume that you want to calculate an Annual Percentage Rate (APR), given a monthly payment and a monthly rate. However, you can modify these techniques to fit other cash-flow assumptions.

```
     A          B          C          D          E          F          G
1    \r         {GetNumber "Amount borrowed? ",PRINCIPAL}
2               {GetNumber "Amount of each monthly payment? ",PAYMENT}
3               {GetNumber "Number of monthly payments? ",TERM}
4               {Let CASHFLOWS,-PRINCIPAL}
5               {Goto}CASHFLOWS~{Down}
6               /cPAYMENT~.{Down TERM-1}~
7               /rncCASHFLOWS~.{End}{Down}~
8               {Let RATE,@IRR(PAYMENT/PRINCIPAL,CASHFLOWS)*12}
9               {Goto}RATE~{Left}{Right}
10              {Blank CASHFLOWS}
11              /rncCASHFLOWS~{Esc}~
12
13   PRINCIPAL
14   PAYMENT
15   TERM
16   GUESS
17   RATE
18   CASHFLOWS
19
```

Figure 1: *This macro automates the process of using an @IRR function to calculate the interest rate for a loan.*

USING THE @IRR FUNCTION Several of our readers, including Kevin Larsen of Lakewood, Colorado, used *Lotus 1-2-3*'s @IRR function to calculate the implied interest rate for a loan. @IRR calculates the internal rate of return for an annuity—the interest rate implied by the annuity cost and its stream of cash flows.

To use this function to calculate the interest rate of a loan (as shown in Figure 1), enter the principal of the loan (the amount borrowed) into a worksheet cell as a negative number. Next, enter the monthly payment as a positive value into the cell below that cell. Then, copy the monthly payment into the $x-1$ cells below the one into which you just entered it, where x is the term of the loan. After creating this range, specify it as the second argument of the @IRR function. The result of the @IRR function is the monthly interest rate for the loan. Multiplying this rate by 12 produces the APR for the loan.

The first three statements in this macro solicit the principal, monthly payment, and term of the loan and enter the user's responses into the cells named PRINCIPAL (B13), PAYMENT (B14), and TERM (B15), respectively. The next statement enters the negative of the value in PRINCIPAL into the cell named CASHFLOWS (B18). Then the statements in cells B5..B6 enter copies of the value in PAYMENT into as many cells below the one named CASHFLOWS as specified by the value in TERM. After *1-2-3* enters these values, the statement in cell B7 expands the range named CASHFLOWS to encompass them.

After *1-2-3* expands the range named CASHFLOWS to encompass the cash flows for the loan, it evaluates the command in cell B9, which enters the result of the function @IRR(PAYMENT/PRINCIPAL,CASHFLOWS)*12 into the cell named RATE (B17). This result is the APR for the loan. As you can see, we've used the formula +PAYMENT/PRINCIPAL as the "seed" value for this @IRR calculation. The result of this formula is the maximum possible rate of interest for the loan—the rate that you would be paying if each payment consisted solely of interest.

The final statements in this macro move the cell pointer to RATE, erase the cash flows from the worksheet, and reduce the range named CASHFLOWS back to a single cell (B18).

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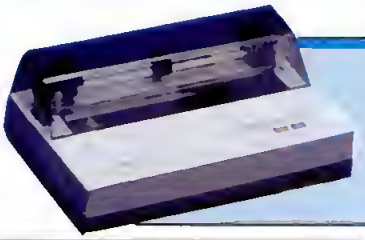
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CIRCLE 183 ON READER SERVICE CARD

■ SPREADSHEET CLINIC

A MULTIPLE-FORMULA APPROACH

Like many of our readers, James R. Bailey of Lubbock, Texas, decided not to use either the @IRR function or a macro. Instead, his solution, shown in Figure 2, consists of the formulas

```
B5:  (PAYMENT/PRINCIPAL)*12
B6:  12*($PAYMENT/$PRINCIPAL)*(1-(1+B5/12)^(-1*$TERM))
B7:  12*($PAYMENT/$PRINCIPAL)*(1-(1+B6/12)^(-I*$TERM))
B8:  12*($PAYMENT/$PRINCIPAL)*(1-(1+B7/12)^(-1*$TERM))
B9:  12*($PAYMENT/$PRINCIPAL)*(1-(1+B8/12)^(-I*$TERM))
B10: 12*($PAYMENT/$PRINCIPAL)*(1-(1+B9/12)^
 (-1*$TERM))
B11: 12*($PAYMENT/$PRINCIPAL)*(1-(1+B10/12)^
 (-1*$TERM))
B12: 12*($PAYMENT/$PRINCIPAL)*(1-(1+B11/12)^
 (-1*$TERM))
B13: 12*($PAYMENT/$PRINCIPAL)*(1-(1+B12/12)^
 (-1*$TERM))
B14: 12*($PAYMENT/$PRINCIPAL)*(1-(1+B13/12)^
 (-1*$TERM))
B15: 12*($PAYMENT/$PRINCIPAL)*(I-(I+B14/12)^
 (-1*$TERM))
```

in cells B5..B15. Cells B1, B2, and B3 are named PRINCIPAL, PAYMENT, and TERM, respectively. The formulas in cells B7..B15 are simply copies of the formula in cell B6.

To use this model, enter the amount you want to borrow into cell B1, the amount of each periodic payment into cell B2, and the number of periods into cell B3. Then, if the worksheet is set for Manual recalculation, press the Calc key.

The formula in cell B5 calculates the maximum possible rate of interest for the loan. The formula in cell B6 acts upon the result of the formula in cell B5; the formula in cell B7 acts upon the result of the formula in cell B6; and so forth. Each successive formula produces a truer (lower) estimate of the interest rate. In most cases, the final formula (the one in cell B15) will return the correct loan rate described by the values in cells B1, B2, and B3. If not, you can make additional copies of that formula.

ITERATIVE MACROS The solutions that are perhaps the simplest to understand were submitted by Michael J. Haberer of Glen Ellyn, Illinois, and Duncan M. Holthausen of Raleigh, North Carolina.

	A	B	C
1	PRINCIPAL	$100,000.00	
2	PAYMENT	$1,000.00	
3	TERM	216	
4			
5	Maximum rate:	12.00%	
6	1st rate estimate:	10.00%	
7	2nd rate estimate:	10.20%	
8	3rd rate estimate:	10.07%	
9	4th rate estimate:	10.03%	
10	5th rate estimate:	10.01%	
11	6th rate estimate:	10.01%	
12	7th rate estimate:	10.00%	
13	8th rate estimate:	10.00%	
14	9th rate estimate:	10.00%	
15	10th rate estimate:	10.00%	
16			

Figure 2: *This worksheet uses a series of converging formulas to calculate the interest rate of a loan.*

```
      A          B          C          D          E          F          G
1   \r         {GetNumber "Amount borrowed? ",PRINCIPAL}
2              {GetNumber "Amount of each monthly payment? ",PAYNENT}
3              {GetNumber "Number of monthly paymenta? ",TERM}
4              {Let RATE,(PAYMENT/PRINCIPAL)*12}
5   LOOP       {Let CALCPMT,@PMT(PRINCIPAL,RATE/12,TERM)}
6              {If @ABS(PAYMENT-CALCPMT)<.001}~{Quit}
7              {Let RATE,(PAYMENT/CALCPNT)*RATE}
8              {Branch LOOP}
9
10  PRINCIPAL
11  PAYMENT
12  TERM
13  CALCPNT
14  RATE
15
```

Figure 3: *This macro calculates the interest rate for a loan by converging upon the one that makes the result of an @PMT function equal to the specified periodic payment.*

Mr. Haberer's macro in Figure 3 plugs different interest rates into an @PMT function that cites the principal and payment values that you specify. The rate that makes the result of the @PMT function equal to the payment you specified is the internal rate of return for the loan.

The first three statements in Mr. Haberer's macro solicit the principal, monthly payments, and term of a loan; then they place the user's responses into the cells named PRINCIPAL (B10), PAYMENT (B11), and TERM (B12), respectively. The next statement calculates the highest possible rate for the loan and enters it into the cell named RATE. The fifth statement in the macro enters the result of the function @PMT(PRINCIPAL,RATE/12,TERM) into the cell named CALCPMT (B13). This function returns the periodic payment for a loan described by the principal, interest, and term values in cells B10, B14, and B12, respectively.

If the result of the @PMT function is not within .001 of the value in PAYMENT, *1-2-3* will execute the statement in cell B7, which replaces the current value in RATE with the result of the formula (PAYMENT/CALCPMT)*RATE, which returns a slightly lower rate. Then, *1-2-3* will branch the execution of the macro back to the cell named LOOP (B5), which recalculates the @PMT function at the new rate.

Each subsequent calculation of the @PMT function produces a result that is closer and closer to the value in PAYMENT. As soon as the result of the function and the value in PMT are within .001 of each other, *1-2-3* will end the execution of the macro. At this point, RATE will contain the interest rate for the loan described by the values in cells B10..B12.

Mr. Holthausen's macro in Figure 4 is similar to Mr. Haberer's. Instead of using an @PMT function to converge upon the interest rate, this macro compares the result of an @PV function with the principal of the loan. The internal rate of return for a loan is the interest rate at which the present value of the periodic payments is equal to the principal of the loan.

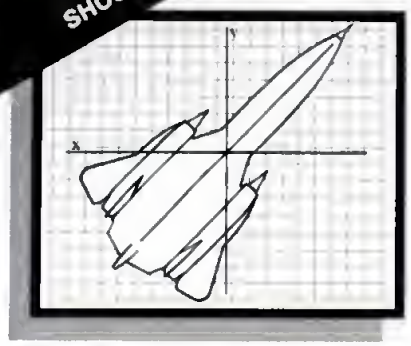
This macro also works similarly to Mr. Haberer's. After soliciting the principal, payment, and term values, it calculates the maximum possible rate of interest for the loan. Then *1-2-3* calculates a present value based on the payment and term values you specified and the rate that it just calculated. If the calculation's result is not within .001 of the principal amount you specified, the macro will revise the rate downward and recalculate the @PV function. When the result of @PV is within .001 of the principal value, *1-2-3* will cancel the execution of the macro. At that point, the RATE value will be the internal rate of return for the loan.

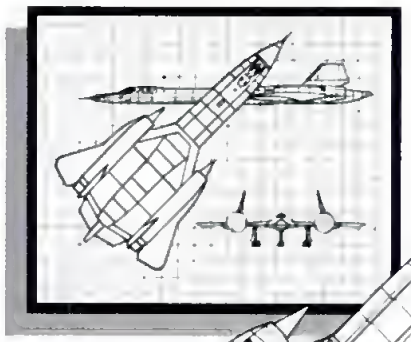
Unlike Mr. Haberer's macro, this one checks the reasonableness of the principal, payment, and term values. If the product of payment and term values is less than the principal value (indicating that the total of the payments will not repay the loan), *1-2-3* branches to the cell named ERROR (B11). An explanatory message will appear at the top of the screen. As soon as the user presses Enter, *1-2-3* will restart the

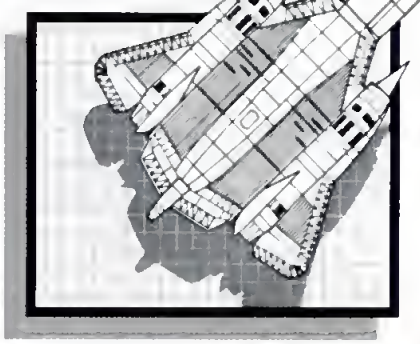
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■ SPREADSHEET CLINIC

```
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1   \r          {GetNumber "Amount borrowed? ",PRINCIPAL}
2               {GetNumber "Amount of each monthly payment? ",PAYMENT}
3               {GetNumber "Number of monthly payments? ",TERM}
4               {If PAYMENT*TERM<PRINCIPAL}{Branch ERROR}
5               {Let RATE,(PAYMENT/PRINCIPAL)*12}
6   LOOP        {Let PV,@PV(PAYMENT,RATE/12,TERM)}
7               {If @ABS(PV-PRINCIPAL)<.001}~{Quit}
8               {Let RATE,(PV/PRINCIPAL)*RATE}
9               {Branch LOOP}
10
11  ERROR       {GetLabel "Total of payments is less than principal.  Press |Enter| to restart...",NULL}
12              {Branch \r}
13
14  PRINCIPAL
15  PAYMENT
16  TERM
17  NULL
18  PV
19  RATE
20
```

Figure 4: *This macro calculates the interest rate for a loan by converging upon the one that makes the result of an @PV function equal to the specified principal amount.*

macro. You can add these error-checking statements to the macro shown in Figure 3.

USING CIRCULAR REFERENCES

Circular references provide a third way to calculate the interest rate for a loan from the principal, payment, and term values. The worksheet shown in Figure 5 contains an example of this technique. Cells B1, B2, and B3 are named PRINCIPAL, PAYMENT, and TERM, respectively. Cell B5, which is named PV, contains the function

```
B5:  @PV(PAYMENT,RATE/12,TERM)
```

Cell B6, which is named RATE, contains the formula

```
B6:@IF(@ISERR(PV),(PAYMENT/PRINCIPAL)*12,
 (PV/PRINCIPAL)*RATE)
```

Since the formula in cell B6 (RATE) references itself, the CIRC indicator will appear at the bottom of the worksheet.

These two formulas calculate the internal rate of return for the loan described by the values in cells B1, B2, and B3 in the same wey that the mecro in Figure 4 does—by converging upon the rate of interest that makes the result of the @PV function equal to the principal of the loan. Each time you press the Calc key, *1-2-3* will first recalculate the function in cell B5, which will return a new present value. Then it will recalculate the formula in cell B6, using the new present value, and return a new rate estimate.

Each time you press the Calc key, the result of the function in cell B5 will get closer to the value in cell B1, and the result of the formula in cell B6 will get closer to the true rate for the loan. When the value returned by the function in cell B5 matches the value in cell B1, the result of the formula in cell B6 will be the internal rate of return for the loan. In most cases, the result of the function in cell B5 will match the value in cell B1 after fewer than 10 recalculations.

If you wish, you can command *1-2-3* to automatically recalculate the worksheet multiple times each time you press the Calc key. That way, you'll only have to press that key once to resolve these formulas. To specify multiple recalculations, issue the /Worksheet Global Recalculation Iteration command, type the number of recalculations you want *1-2-3* to perform each time you press the Calc key, and press Enter.

If you wish, you can use *1-2-3*'s {Recalc} command to control the recalculation of a circular reference. The optional second argument of this command allows you to instruct *1-2-3* to keep calculating the specified range until the result reaches the degree of precision you want.

Cells B11 and B12 of the worksheet shown in Figure 6 contain the formulas

```
B11:  @PV(PAYMENT,RATE/12,TERM)
```

and

```
B12:@IF(@ISERR(PV),(PAYMENT/PRINCIPAL)*12,
 (PV/PRINCIPAL)*RATE)
```

```
      A            B            C
1   PRINCIPAL    $100,000.00
2   PAYMENT        $1,000.00
3   TERM                216
4
5   PV           $100,000.00
6   RATE              10.00%
7
```

Figure 5: *Pressing the Calc key repeatedly resolves the converging circular references in cells B5 and B6 of this worksheet.*



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■ SPREADSHEET CLINIC

```
      A          B          C          D          E          F          G
1   \r          {GetNumber "Amount borrowed? ",PRINCIPAL}
2               {GetNumber "Amount of each monthly payment? ",PAYMENT}
3               {GetNumber "Number of monthly payments? ",TERM}
4               {Recalc FORMULAS,@ROUND(PV,2)=PRINCIPAL}
5
6
7   PRINCIPAL
8   PAYMENT
9   TERM
10
11  PV
12  RATE
13
```

Figure 6: *This macro uses an optional argument of the {Recalc} command to resolve the converging circular formulas in cells B11 and B12.*

respectively—the same circular formulas that are in cells B5 and B6 of the worksheet shown in Figure 5. The macro in cells B1..B5 of that worksheet controls the recalculation of those formulas. The first three statements in this macro solicit the principal, payment, and term for the loan, and place the user's responses into cells B7 (PRINCIPAL), B8 (PAYMENT), and B9 (TERM), respectively. Then, the statement in cell B4 commands *1-2-3* to recalculate the formulas in cells B11 and B12 (collectively named FORMULAS) repeatedly until the result of the function in cell B11, rounded to two digits to the right of the decimal point, is equal to the value in the cell named PRINCIPAL. At that point, the result of the formula in cell B12 will be the interest rate for the loan.

A NOTE TO OUR READERS Because of space restrictions, we were able to present only what we considered to be the best of the many responses to Mr. Gunsteens's challenge. We thank everyone who took the time to submit a solution, and we encourage you to write us again.

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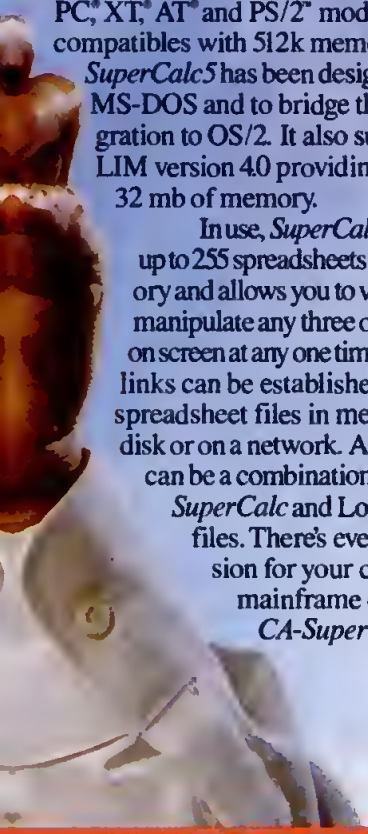


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CIRCLE 359 ON READER SERVICE CARD

■ NEIL J. RUBENKING



USER-TO-USER

Using DEBUG to load, alter, and display any nontext file and to debug programs; completely deleting a file so it cannot be reconstructed by a recovery program.

Debugging programs is an arcane art, one best practiced by those who write the programs in the first place. But the DEBUG .COM utility that came with your DOS package is good for much more than debugging. Its secondary purpose is to "load, alter, or display any file," and you can use it for that purpose without learning to add 84E7 and 02CF.

Clearly you can alter or display a text file with a word processor. DEBUG is generally used with programs and other nontext files. Using DEBUG you can scan an unknown program looking for suspicious messages like "Arf! Arf! Gotcha!" or change program messages to suit your preference. We'll demonstrate both techniques below.

In the March 15, 1988, issue of *PC Magazine*, you'll find a Help File listing all of the DEBUG commands. This will be especially useful if you have one of the newer DOS versions that remove the DEBUG commands from the regular manual. If you have the Help File, refer to it as we go along.

FINISH WITH A BEEP Formatting a disk can take a couple of minutes, long enough that you don't want to sit and watch for it to finish. Wouldn't it be nice if FORMAT would beep to say it's done? With DEBUG you can change the final "Format another (Y/N)?" message to include a special character that will beep the speaker.

Whatever version of DOS you have, you can work out the patch to FORMAT .COM by using the technique below. You will use the DEBUG commands Register, Search, Dump, Enter, Write, and Quit. To give DEBUG a command, simply type the first letter, type any parameters, and then press Return. Figure 1 displays both the user commands and DEBUG's responses for the whole procedure. Do note that the size and addresses in the figure will not necessarily match those on your system.

```
C:\DOS>DEBUG FORMATX.COM
-RCX
CX 2D60
:
-S CS:100 L 2D60 'Format another'
46E2:2105
-D 46E2:2185
46E2:2180                       46 6F 72-6D 61 74 20 61 6E 6F 74        Format anot
46E2:2190  68 65 72 20 28 59 2F 4E-29 3F 00 49 6E 73 65 72   her (Y/N)?.Inser
46E2:21A0  74 20 44 4F 53 20 64 69-73 6B 20 69 6E 20 64 72   t DOS disk in dr
46E2:21B0  69 76 65 20 25 63 3A 0D-0A 61 6E 64 20 73 74 72   ive %c:..and str
46E2:21C0  69 6B 65 20 45 4E 54 45-52 20 77 68 65 6E 20 72   ike ENTER when r
46E2:21D0  65 61 64 79 0D 0A 00 52-65 2D 69 6E 73 65 72 74   eady...Re-insert
46E2:21E0  20 64 69 73 6B 65 74 74-65 20 66 6F 72 20 64 72    diskette for dr
46E2:21F0  69 76 65 20 25 63 3A 00-56 6F 6C 75 6D 65 20 6C   ive %c:.Volume l
46E2:2200  61 62 65 6C 20                                    abel
-E 46E2:2185 'Format another'07
-D 46E2:2185
46E2:2180                       46 6F 72-6D 61 74 20 61 6E 6F 74        Format anot
46E2:2190  68 65 72 07 28 59 2F 4E-29 3F 00 49 6E 73 65 72   her.(Y/N)?.Inser
46E2:21A0  74 20 44 4F 53 20 64 69-73 6B 20 69 6E 20 64 72   t DOS disk in dr
46E2:21B0  69 76 65 20 25 63 3A 0D-0A 61 6E 64 20 73 74 72   ive %c:..and str
46E2:21C0  69 6B 65 20 45 4E 54 45-52 20 77 68 65 6E 20 72   ike ENTER when r
46E2:21D0  65 61 64 79 0D 0A 00 52-65 2D 69 6E 73 65 72 74   eady...Re-inaert
46E2:21E0  20 64 69 73 6B 65 74 74-65 20 66 6F 72 20 64 72    diskette for dr
46E2:21F0  69 76 65 20 25 63 3A 00-56 6F 6C 75 6D 65 20 6C   ive %c:.Volume l
46E2:2200  61 62 65 6C 20                                    abel
-W
Writing 2D60 bytes
-Q
```

Figure 1: *This is an example of patching FORMAT.COM. You type in the italicized items.*

First, make a copy of FORMAT.COM and name it, say, FORMATX.COM. When you're patching a file in DEBUG, always do it on a copy! Make sure that DEBUG is available either in the current directory or on the PATH. Then load FORMATX.COM into DEBUG with the following command:

```
DEBUG FORMATX.COM
```

You'll get a dash prompt, nothing more. DEBUG doesn't have a help key.

The first thing you need to do is find out how many bytes are in the program. When DEBUG loads a program, it stores the program's size in the CX register. Some DEBUG commands can cause this value to change—check it immediately after starting DEBUG using the command

```
RCX
```

On the next line, you will see CX followed by a four-digit number. Make a note of the

■ USER-TO-USER

number and hit the Return key. It is a hexadecimal number, so it may contain the letters A through F in addition to Arabic numerals. To locate the message in the program, use the Search command

```
S CS:100 L #### 'Format another'
```

where #### is the number you noted. CS:100 means the beginning of the program; we want to search from the beginning. L #### indicates the length of the area to search—in this case, the whole program. The character string in single quotes is the object of our search.

Make a note of the address returned by Search; it will be two hexadecimal numbers separated by a colon (46E2:2185, for example). Display the bytes at that address using the Dump command

```
D ####:####
```

where ####:#### is the address you got. The result will be a three-column display like that in the middle of Figure 1.

The first column contains an address, and the wide middle column lists 16 bytes starting at that address. The last column shows the characters corresponding to those bytes. You should see the "Format another" message there.

You'll insert the changed message with the Enter command

```
E ####:#### 'Format another'07
```

E ####:#### says you're entering new bytes at the address you noted. The new bytes consist of the same message as before followed by the byte 07. Instead of a space between "Format another" and "(Y/N)?" you now have a BEL character. Writing this character causes the speaker to beep.

To confirm that the change was successful, Dump the data again

```
D ####:####
```

using the same address. In the last column, you'll see a period after "another": DEBUG represents all nonprintable characters with a period. Find the corresponding byte in the middle column and you'll see that it's 07.

Assuming all went well, you're ready to finish up by entering

```
W
Q
```

W writes the file back to disk; Q quits. Now you have a copy of FORMAT.COM that will beep after it formats a disk.

When you use DEBUG to change messages, remember that the new message must never be longer than the old. A longer message will overwrite the next part of the program, very likely causing it to crash. Note also that DEBUG will not Write changes to an .EXE file. That's no big problem: just rename the file to some other extension while you're modifying it.

WHAT'S IN A FILE? You used the Dump command to look at the message in FORMAT.COM. Dump can, however, display any part of any file. Pure program code looks like gibberish when you Dump it, but often there are text messages embedded in the code.

To look at the contents of a file, load it into DEBUG from the command line. Check the length of the file with the RCX command, just as in the previous example. Now give the command

```
D CS:100 L ####
```

where #### is the file size from RCX. The contents of the file will scroll past on the screen. You can stop the scrolling temporarily with the Ctrl-S or Ctrl-NumLock key and start it again with any other key. You can also end the display with Ctrl-C or Ctrl-Break.

If you want to study every byte, you can dump just eight lines at a time. You won't have to press Ctrl-S to stop the display, but you will have to enter the D command after each eight lines. To do it this way, start with the command

```
D CS:100
```

As you finish looking at a block of bytes, give the Dump command again with no parameters—D alone. Note that it's up to you to know when to stop. Watch the second half of the address in the first column. When it reaches the file size, you have four more Dumps to go until the end of the file.

DEBUG—A USEFUL TOOL Don't think of DEBUG as a debugger—it can't compare to modem tools like CodeView and Periscope. Think of it as a byte-level file editor. Its command language is a bit awkward, but the price is right.

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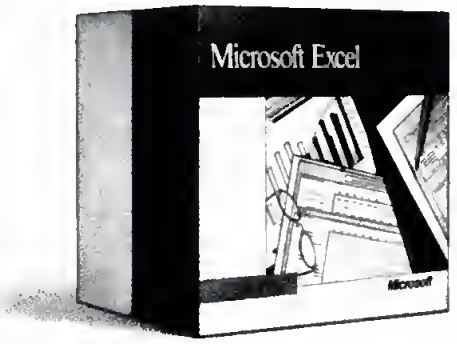
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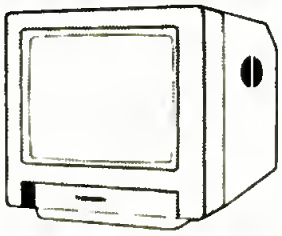
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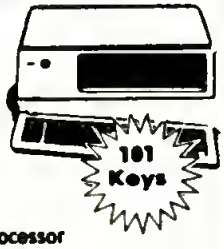
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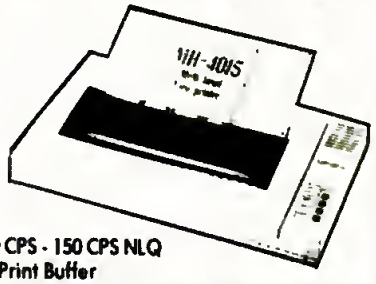
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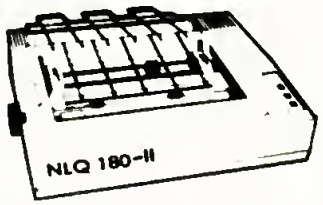


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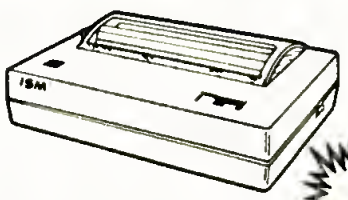
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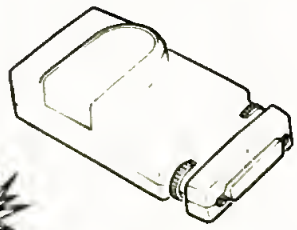
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■ USER-TO-USER

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```
WIPE FILENAME
```

where FILENAME is the filename you want to delete. The WIPE command will delete the original file, then it will copy the WIPE.DAT file (shown in Figure 3) to that filename and delete it once again. Now anyone who attempts to undelete the file will get whatever you entered in WIPE .DAT.—*Mark Komarinski; Schenectady, New York*

```
ECHO OFF
CLS
IF "%1" == "" GOTO HELP
ECHO The file %1 is about to be permanently deleted!!
ECHO to exit press [CTRL-BREAK] or
PAUSE
DEL %1
COPY WIPE.DAT %1 > NUL
DEL %1
ECHO %1 deleted
GOTO END
:HELP
ECHO To permanently delete a file, type
ECHO            WIPE  name
ECHO Where name is the file you wish to wipe
:END
```

Figure 2: *WIPE out files to help prevent the possibility of unerasing.*

If you wipe out a large file using this method, a determined person could still reconstruct all but the beginning of the file by hand. Still, foiling all who merely own unerase utilities is a major advantage. Do note that if you pass a filename with wildcards to WIPE.BAT, the line

```
COPY WIPE.DAT %1 > NUL
```


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■ USER-TO-USER

```
This file has been wiped....^G^G^G
```

Figure 3: *The possible contents of a WIPE.DAT file. ^G represents Ctrl-G.*

```
ECHO OFF
CLS
IF "%1" == "" GOTO HELP
ECHO Files matching %1 are about to be permanently deleted!!
ECHO To exit press [CTRL-BREAK] or
PAUSE
ECHO This file has been wiped... > WIPE.DAT
FOR %%f IN (%1) DO COPY WIPE.DAT %%f > NUL
DEL WIPE.DAT
DEL %1
ECHO %1 deleted
GOTO END
:HELP
ECHO To permanently delete a file or set of files, type
ECHO             "WIPE  filespec"
ECHO ...where filespec may contain wildcards.
:END
```

Figure 4: *WIPE2.BAT, a version of WIPE.BAT, works with wildcards.*

will not overwrite the previously used filenames.

Figure 4 is a version of WIPE.BAT that accepts wildcards. First, since WIPE.DAT may not be handy on the current drive and directory, it creates its own copy. Then it simply copies WIPE.DAT onto each file in turn, using the FOR command. Only after overwriting all the matching files does WIPE2.BAT delete them.

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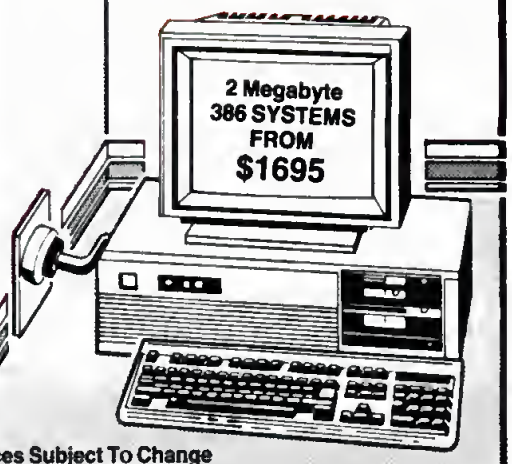
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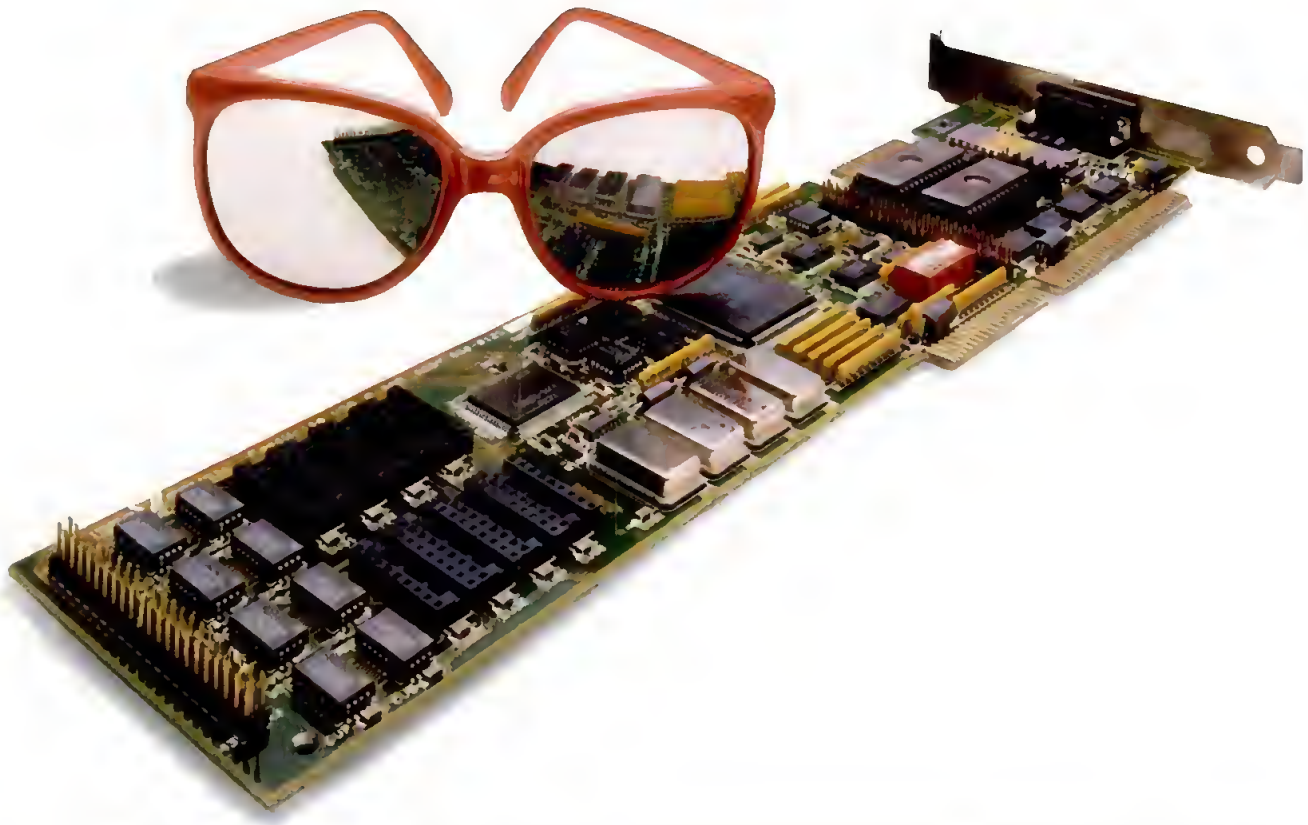
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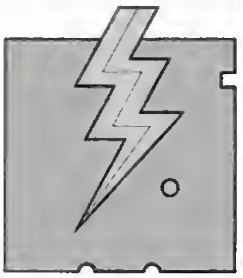
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■ EDITED BY CRAIG L. STARK



POWER USER

How to copy blocks of text in WordPerfect, open a window in Word to write a quick note, and break up large dBASE III Plus files to make floppy disk backups.

Here's a way to break up oversize *dBASE III Plus* files so you can make floppy disk backups

A serious failing in *dBASE III Plus* is that it provides no way to back up a large database onto floppy disks. HD2FLOPY.PRG, shown in Figure 1, provides a simple and safe solution to this problem.

The DISKSPACE() function determines the capacity of the floppy disk, so the program will work with any 5¼-inch or 3½-inch drive. The database's header size is calculated by multiplying the number of fields by 32 bytes and adding 35. The integer of the floppy's DISKSPACE(), minus the header, divided by the record size determines how many records each floppy disk can hold. This number is then copied to a series of floppies. The user is prompted to insert each new (formatted) disk required.—*Danny Case; Columbia, South Carolina*

```
*** HD2FLOPY.PRG
SET TALK OFF
CLEAR
odbf=SPACE(30)
fdrive="A"
ndbf=SPACE(8)
@ 1,0 SAY "Backup which database?" GET odbf
@ 3,0 SAY "To which floppy drive?" GET fdrive
@ 5,0 SAY "Enter Backup filename:" GET ndbf
READ
odbf=TRIM(odbf)
ndbf=TRIM(ndbf)
fmess="Insert a blank, formatted disk in ";
     +"Drive &fdrive, and press a key..."
IF READKEY()=12
  RETURN
ENDIF
IF ndbf<=" "
  ? [No TARGET file]+CHR(7)
  RETURN
ENDIF
IF FILE(odbf) .OR. FILE(odbf+".DBF")
  USE &odbf
ELSE
  ? [No SOURCE file: "&odbf"]+CHR(7)
  RETURN
ENDI

SET DEFAULT TO &fdrive
DO WHILE DISKSPACE()<1
  WAIT fmess
ENDDO

* Calc header size
STOR 0 TO fldno,header
DO WHILE ""<FIELD(fldno+1)
  fldno=fldno+1
ENDDO
header=32*fldno+35

* Calc # of floppies needed
floprecs=INT((DISKSPACE()-header)/RECSIZE())
flopneed=INT((RECCOUNT())/floprecs)+1
makeflop="F"
DO WHILE makeflop$"Ff"
  ? STR(flopneed)+" Disks required.  "
  ?? "Press <ENTER> to proceed."
  WAIT "To format additional disks, insert ";
      +"floppy and press <F>" TO makeflop
  IF makeflop$"Ff"
    RUN FORMAT &fdrive:
  ENDIF
ENDDO

sofar="0"
DO WHILE .NOT. EOF()
  SET TALK ON
  sofar=LTRIM(STR(VAL(sofar)+1))
  COPY NEXT floprecs TO &ndbf..&sofar
  SET TALK OFF
  IF .NOT. EOF()
    SKIP
    DO WHILE DISKSPACE()<RECSIZE()+header
      WAIT fmess
    ENDDO
    ENDIF
  ENDDO
  SET DEFAULT TO C
```

Figure 1: *This program lets you back up large* dBASE III Plus *files onto floppy disks.*

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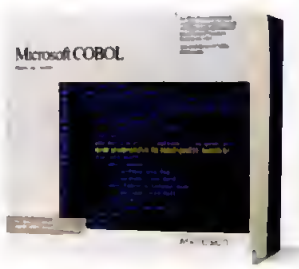
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■ POWER USER

Since the ability to back up to floppies is such an obvious need, it's surprising that the makers of *dBASE III Plus*, *FoxBASE*, *Clipper*, *dBXL*, and *Quicksilver* all have failed to build in the necessary coding.

I've taken the liberty of expanding Mr. Case's routine to include a number of additional features. The program now asks for the database and backup filenames, allows the Esc key to exit, checks that the specified database exists, notifies the user how many floppies will be needed, provides an option to format additional floppies, and sequentially numbers the backup floppies used.

HD2FLOPY creates an independent database on each floppy disk. To restore the complete database, therefore, you should copy the first floppy to your hard disk, change the filename extension of the first floppy from ".1" to ".DBF," USE this database in *dBASE*, and APPEND FROM each of the successive floppies.

When using HD2FLOPY, notice that the source filename can be up to 30 characters long. This gives you the option of specifying the hard disk's drive and subdirectory as well as the database filename. On the other hand, the backup filename can be only 8 characters long; you must *not* specify a filename extension for it, since the program uses this part of the filename to number the sequence.

Notice the SET DEFAULT TO commands. Because the DISKSPACE() function does not permit passing the drive letter as a parameter, the program must SET DEFAULT TO the floppy disk drive before calling the DISKSPACE() function. The last program command resets the default to drive C:, which you may wish to change if you use a different default.—*Brad Stark*

How to open a notepad window in *Word* and save it, even if the filename already exists

For all those times you need to interrupt your work to write a quick note, here's a macro that will open a window in *Microsoft Word*, let you write a note, save the note to disk, and let you get on with your work. For increased readability, the macro is broken into lines that represent discrete functions. However, you should enter this macro as a single line:

```
<ctrl esc>wsv68<tab>y<enter>
<ctrl f1>date<f3><enter>time<f3><enter><enter>
•pause To end the note, type ENTER•
<esc>ts•pause Enter filename•<enter><enter>
<esc>wc<enter>
```

The first line opens a vertical window; the second line zooms it to full screen and enters the date and time. The macro then pauses while you write your note. The fourth line saves the file, pausing for you to enter a filename. The final line closes the window.

One problem with this macro—and with *Word* macros in general—crops up in connection with the Save command. If you enter a filename that already exists, the macro does not save the file or close the window. Instead, it goes back to the note window, writes "wc" in the note, and leaves you with the note unsaved. The problem is that there is no way (at least Microsoft was unable to suggest one) to loop back to give you a second chance to enter a filename. You just have to be careful when selecting the filename.—*Richard E. Hanners; Stevensville, Montana*

Actually, there is an easy—if somewhat inelegant—way to solve the problem: simply break the macro in two and let the first macro save the file immediately after opening the window. Starting with Mr. Hanners's macro above, delete the pause to enter the note and end the macro after the Transfer Save command. After entering the note, invoke a second macro to close the window and save the note to the filename you've already picked. This has the added advantage of letting you hit Return while entering the note, without accidentally returning control to the macro.

If you want to do everything within a single macro, you can also solve the Save problem by using the While . . . Endwhile instruction. Starting with the first line after the pause for writing the note, change the macro to

```
wc<f6><left 2><del>
•While scrap="wc"•
<esc>ts•pause Enter filename•<enter><enter>
<esc>wc<ctrl esc><esc>
<left><f6><left><ctrl esc>c<enter>
•If scrap = "wc"•<del>•endif•
•endwhile•
<esc>wc<enter>
```

The first line sets up the scrap "wc," and the second line tells *Word* to keep repeating everything between this point and the endwhile instruction as long as the scrap is

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■ POWER USER

```
<Ctrl-F10>              Begin macro definition
<Alt-C>                 Call it Alt-C, for Copy
<Alt-145>               Place a bookmark
<Ctrl-PgUp><CR><CR>     Pause for user to move the cursor to start of text to be copied.
<Alt-F4>                Block-on
<Ctrl-PgUp><CR><CR>     Pause for user to highlight the text to be copied.
<Ctrl-F4><2>            Copy block
<Home><Home><Up>        Home the cursor.
<F2><Alt-145><F2>       Find the bookmark
<Backspace>             Erase the bookmark.
<Ctrl-F4><5>            Perform the copy
<Ctrl-F10>              End macro definition
```

Figure 2: *A* WordPerfect *macro for copying text to the current cursor location.*

"wc." The third line has the command to save the note. The fourth line is a dummy version of the command to close the window. If the file has not been saved, the "wc" will be written into the note as text. If the file has been saved, the "wc" will be interpreted as a command to the program. Either way, the

```
<ctrl esc><esc>
```

macro code at the end of the line forces *Word* into edit mode, so that the fifth line can read the last two characters before the highlight and copy them to the scrap. The sixth line tests to see if the last two characters were "wc" and deletes them if they were. The last line, after the endwhile instruction, actually closes the window.

Finally, be aware that this macro assumes that you are not already working in a zoomed window when you call it up. If you are in a zoomed window, the macro will not behave the way you expect it to.—*M. David Stone*

Productivity Tip

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A *WordPerfect* macro that simplifies duplicating blocks of text

When I type my short business letters with *WordPerfect*, I usually have to repeat portions elsewhere in the letter. Only after the cursor is at the target location, however, do I start thinking about what to copy and where to copy it from. Thus the macro shown in Figure 2 assumes that the cursor is positioned at the target location and fetches text to it.

The macro first marks the target location. Then it lets the user point to the beginning of the text to copy. Pressing Enter begins the block, and after the whole area to be copied is highlighted, pressing Enter again copies the text to the target position.—*Irfan Atatekin; Montreal, Quebec, Canada*

Note that to enter the <Alt-145> shown in Figure 2, you must hold down the Alt key, press 1,4,5 on the numeric keypad, then release the Alt key. The top-row number keys will not work. On your screen this will show up as the character æ. This character was an arbitrary choice—you could use any character that doesn't appear elsewhere in your document.

After the macro reaches the first <Ctrl-PgUp> and stops for user input, each step in the macro will show on the screen. This may cause some annoying flashing effects. You can minimize the disruption by inserting the line

```
<Ctrl-PgUp>255<CR>
```

in the macro immediately after the *second* <Ctrl-PgUp><CR><CR> instruction in Figure 2.—*Neil J. Rubenking*

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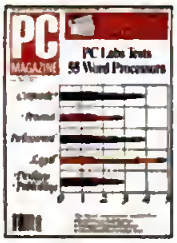
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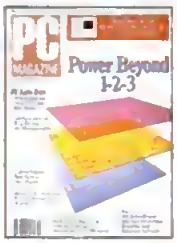
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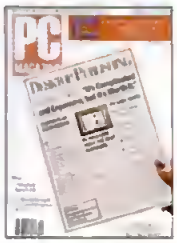
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LANGUAGES

A simple way to embed printer control codes in FORTRAN; enhancing the DIR command in Turbo Pascal; generating C source code listings with numbered lines.

Writing to screen pages other than 0 in Turbo Pascal

It is simple to write to a screen page other than 0 using BASIC, but in Turbo Pascal 3.0, the Write command always writes to page 0. Figure 1 shows three procedures in Turbo Pascal to manipulate the multiple pages of screens available on the PC (four in 80-column mode and eight in 40-column mode). To convert this figure to work with Version 4.0, use the compiler's UPGRADE.EXE with the 13 option.

The SetPage procedure uses BIOS interrupt 10h function 5 to set the current active, or visual, page. The ClrPage procedure performs the same function as Turbo Pascal's ClrScr function on any page. Pass the procedure the screen you want cleared and the background color you want it set to. This procedure uses BIOS interrupt 10h function 2 to position the cursor and function 9 to write a character with attribute byte. Procedure PutPage will write a character string to any selected page. You must also specify the column and row to print on, and the foreground and background color.

I've included a program to demonstrate the three procedures. The program writes the word "Data" on rows 1 to 24 on the three nonactive screens. I use white for the foreground color and set the background color to the screen number.—*Al Bull; Mount Morris, Illinois*

```
{$R+,C-}
PROGRAM PageDemo;
TYPE
  String80 = STRING[80];
  Regpack = RECORD
    CASE Integer OF
      1:(AX,BX,CX,DX,BP,SI,DI,DS,ES,Flags : Integer);
      2:(AL,AH,AL,BH,CL,CH,DL,DH : Byte);
    END;
VAR
  Regs  : RegPack;
  Data  : String80;
  I, J  : Integer;
  dummy : Char;


  PROCEDURE Setpage(page : Byte);
    { Sets the current displayed page using INT 10h.  All "Writes" }
    { still goes to page 0 -- this procedure just changes which    }
    { page is visible.                                             }
  BEGIN
    Regs.AH := 5;
    Regs.AL := page;
    Intr($10, Regs);
  END;

  PROCEDURE ClrPage(Page, Background : Byte);
    { Clears the page using INT 10h services to write spaces }
    { over the whole page.                                   }
  BEGIN
    WITH Regs DO
      BEGIN
        (** Locate cursor first **)
        DL := 0;              { Column              }
        DH := 0;              { Row                 }
        BH := Page;           { Page                }
        AH := 2;              { Set Cursor Position }
        Intr($10, Regs);
        (** Now write characters **)
        AH := 8;              { Write Char w/ attr. }
        BH := Page;           { Page                }
        AL := Background*16;  { attribute byte      }
        AL := Ord(' ');       { Char to write       }
        CX := 2000;           { # of times to write }
        Intr($10, Regs);
      END;
  END;


  PROCEDURE PutPage(VAR Data : String80; Page, Col, Row, Back, Fore : Byte);
    { Uses INT 10h to write a string to the selected page. }
    { Arguments are:                                       }
    {    1) A String[80] to write     }
    {    2) the Page to Write to      }
    {    3) the Column To Start at    }
    {    4) the Row To Write in       }
    {    5) the BackGround Color      }
    {    6) the Foreground Color      }
  VAR
    Endcol : Byte;
    L, I   : Integer;
  BEGIN
    Col := Col-1; {Turbo uses 1..80, BIOS uses 0..79}
    Row := Row-1; {Turbo uses 1..25, BIOS uses 0..24}
    IF (Col < 0) OR (Col > 79) THEN Col := 0;
    IF (Row < 0) OR (Row > 24) THEN Row := 0;
    IF (Page < 0) OR (Page > 3) THEN Page := 0;
    L := Length(Data);
    EndCol := Col+L;
    IF EndCol > 79 THEN
      BEGIN
        EndCol := 79;
        L := EndCol-Col;
      END;
    FOR I := 0 TO (L-1) DO
      BEGIN
        WITH Regs DO
          BEGIN
            {  **  Locate Cursor First  ** }
            DL := Col+I;       { Column              }
            DH := Row;         { Row                 }
            BH := Page;        { Page                }
            AH := 2;           { Set Cursor Position }
            Intr($10, Regs);
```

(continues)

Figure 1: *A program for writing to and displaying all of the CGA's video pages.*

■ LANGUAGES

```
            { How Write Character }
            AH := 9;            { Write Char w/ attr. }
            BH := Page;         { Page                }
            BL := Back*16+Fora; { attributa byta      }
            AL := Ord(Data[I+1]); {char to write      }
            CX := 1;            { # of timea to write }
            Intr($10, Rega);
          END;
      END;
  END;

BEGIN
  WriteLn('WARNING: ONLY works on color/graphics systems.');
  FOR J := 1 TO 3 DO
    BEGIN
      Data := 'Data Data Data Data Data Data Data Data '+
              'Data Data Data Data Data Data Data Data ';
      WriteLn('Building Page ', J);
      ClrPage(J, J);
      FOR I := 1 TO 24 DO
        Putpage(Data, J, 1, I, J, White);
      Data := 'Press any key to continue...';
      PutPage(Data, J, 1, 25, White, J);
    END;
  WriteLn('Press key for first page'); Read(Kbd, dummy);
  setpage(1); Read(Kbd, dummy);
  setpage(2); Read(Kbd, dummy);
  setpage(3); Read(Kbd, dummy);
  setpage(0); WriteLn('We''re back'); {Read(Kbd, dummy);}
END.
```

(Figure 1 ends)

The process of writing to another video page using the BIOS is no faster than writing to the currently active page; however, displaying the prepared pages is almost instantaneous. Note that you could directly address video RAM for the hidden pages without getting any snow.—*Neil J. Rubenking*

Productivity Tip

In many instances, using the REDIM command instead of DIM to create an array makes a lot of sense. When the REDIM command is used in a subprogram that is called more than one time, it eliminates the error caused by trying to dimension the same array again. However, there's an even better reason to use the REDIM command. REDIM forces QuickBASIC to store the array in FAR memory, where it doesn't reduce the available string space.

Generate numbered C source code listings easily with NUMLIST

All too often my C compiler produces messages like "Syntax error, Line 17." It's handy, at times like those, to be able to refer to a source listing with numbered lines. The program NUMLIST.C, shown in Figure 2, reads any ASCII file and prints the contents of that file, preceding each line with a number, to standard output (stdout).—*Robert Bernay; Laguna Beach, California*

The NUMLIST program is short but just as sweet as they get. After the argument checking and file opening is complete, a simple `for` loop does the whole job. To ensure that any error messages are visible even if output is redirected, they are printed to standard error (stderr), which always goes to the screen.

```
/* numlist.c
    List programs with line numbers.  For MSC 4.0/5.0 and TC 1.0
        To compile for MSC:  cl numlist.c
        To compile for TC:   tcc numlist
 */
#include <stdio.h>
#include <string.h>

FILE *infil;                    /* FILE TO BE CHECKED */
char linebuf[BUFSIZ];           /* LINE BUFFER FOR READING FROM FILE */

main(argc,argv)
char *argv[];
int argc;
{
    int line_cnt;

        /* check arguments for filename or '?' (help) fleg */
    if((argc < 2) || strchr(argv[1],'?'))
    {
        fputs("\007Usage:",stderr);
        fputs("  numlist [d:path\\]inputfile\n",stderr);
        fputs("                  or  numlist \
            [d:path\\]inputfile > [d:path\\]outputfile",stderr);
        exit(1);
    }

    if(!(infil = fopen(argv[1],"r")))   /* open input file */
    {
        fprintf(stderr,"\007CAN'T OPEN INPUT FILE: %s!",argv[1]);
        exit(1);
    }

        /* get each line and print it preceded by the line number */
    for( line_cnt = 1; fgets(linebuf,BUFSIZ,infil); line_cnt++)
        printf ("%3d %s",line_cnt, linebuf);

    fclose(infil);                      /* open the file */
    exit(0);
}
```

Figure 2: *Generate a numbered program listing using this simple C program.*

Each line in the source file is read in using the `fgets` function, and written with a line-number prefix. The listing will be displayed on the screen by default but may be redirected to a disk file with the following command:

```
numlist filename.c > filename.lst
```

To generate a printed copy of the NUMLIST.C program listing, type in the following command:

```
numlist filename.c > prn
```

The BUFSIZ constant, defined in the STDIO.H header file in most C implementations and usually set to 512, is adequate for most jobs of this nature.—*Richard Hale Shaw*

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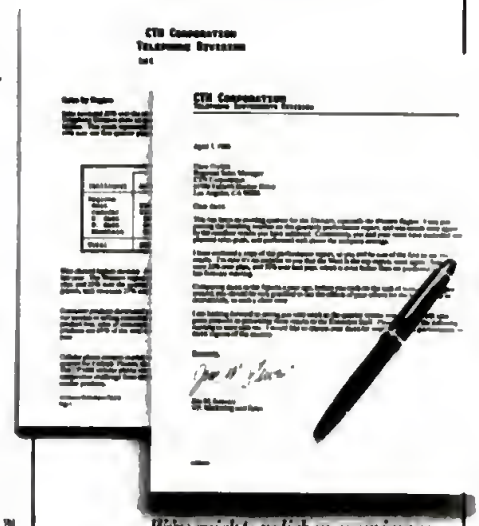
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A simple Turbo Pascal program that enhances the DIR command

Sometimes you need to know the space required by all files on a subdirectory, or a subset of those files. Many times I wanted to copy a set of files to a diskette and had to add up the file sizes from the directory to see if they would fit.

To overcome the problem, I wrote a Turbo Pascal filter (Figure 3) that does the job. Invoke it by

```
DIR | SUMDIR
```

or

```
DIR [filespec] | SUMDIR
```

where "filespec" may contain wildcard characters. For example,

```
DIR *.PAS | SUMDIR
```

would find the sizes of all .PAS files.—*B. Bloch; Haifa, Israel*

Now, why couldn't DOS tell us this? It has all the information, after all. But since DOS doesn't, Mr. Bloch's filter is a big help. The output of DIR | SUMDIR is just the same as that of DIR, except the final line includes the total size of the files. —*Neil J. Rubenking*

```
{$P512,G512,D-,R+}
{ USAGE: e.g., "DIR | SUMDIR" or "DIR *.PAS | SUMDIR" }
PROGRAM SumDir;
VAR
  Line       : STRING[255]; {input line from directory    }
  Code       : Integer;     {error code for VAL procedure }
  FileLenStr : STRING[7];   {file-length part of Line     }
  FileLen,                  {file length as a number      }
  Sum        : Real;        {total of file lengths        }

BEGIN
  Sum := 0;
  WHILE NOT EoF DO
    BEGIN
      ReadLn(line);                              {Read a directory line}
      IF (Line[0] >= #22) AND (Line[1] <> ' ') THEN
        BEGIN
          FileLenStr := Copy(line, 15, 7);{Extract file length  }
          WHILE FileLenStr[1] = ' ' DO    {Strip leading blanks }
            Delete(FileLenStr, 1, 1);
          Val(FileLenStr, FileLen, Code); {Make it a number     }
          IF code = 0 THEN
            Sum := Sum+FileLen;           {Add it to the sum    }
          WriteLn(Line);
        END
      ELSE
        BEGIN
          IF Copy(line, 11, 7) = 'File(s)' THEN
            {this is the LAST line of the directory -- fix it}
            BEGIN
              WHILE Line[1] = ' ' DO      {Strip leading blanks }
                Delete(Line, 1, 1);
              Write(sum:10:0,' bytes in ');
            END;
          WriteLn(Line);
        END;
    END;
END.
```

Figure 3: *A filter to add a file-size sum to a directory listing.*

Embedding printer control codes as literal FORTRAN strings

Standard FORTRAN doesn't provide much control over screen output, but it does provide limited printer carriage control. This requires, however, that output be sent directly to the printer from within the executing program. For example, a 1 in the first column of a line will cause the printer to skip to a new page. Unfortunately, if program output is sent to a DOS text file to be printed later, carriage control in column 1 is ignored and the characters themselves are printed.

I discovered that ASCII control characters, when placed within a literal field in a FORMAT statement, will be accepted by the Microsoft FORTRAN compiler and pass directly through to the output file. To embed a form-feed character in the output file, therefore, one need only place a Ctrl-L (^L) within the literal field of the desired FORMAT statement in the FORTRAN source code. When the output file is printed by way of the DOS PRINT command, the Ctrl-L will be interpreted as a form feed and the printer will advance to a new page.

The short program FORMFD.FOR in Figure 4 demonstrates this. When the out-

```
C  THIS PROGRAM DEMONSTRATES THE USE OF ASCII CONTROL CHARACTERS
C  FOR CARRIAGE CONTROL IN FORTRAN PROGRAMS THAT WRITE TO
C  SEQUENTIAL OUTPUT FILES.
C
      PROGRAM FORMFD
      OPEN (UNIT = 9, FILE = 'DEMO.DAT', STATUS = 'NEW')

      WRITE (9,10)
00010 FORMAT ('This line prints on page 1')

      WRITE (9,20)
00020 FORMAT ('^L','This line will print on page 2')

      STOP
      END
```

Figure 4: *The program listing for FORMFD.FOR demonstrates the use of ASCII characters in FORTRAN programs that write to sequential output files.*

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put file, DEMO.DAT, is sent to the printer, the line "This line prints on page 1" is printed on the first page, and the second WRITE statement will cause the printer to advance to a new page before printing "This line will print on page 2." If DEMO.DAT is listed on the screen instead, the Ctrl-L will appear as a control character.—*Richard P. Mignogna; Golden, Colorado*

The key to this technique is creating the FORTRAN source file with a program editor that can handle these characters. Using the *WordPerfect* Program Editor, for example, I was able to directly enter complete printer escape code sequences for the Hewlett-Packard LaserJet as well as high-bit line-drawing characters from the IBM character set directly into FORTRAN strings.

The control characters ^A through ^Z represent the ASCII values 1 through 26, respectively. The Esc character can be entered as ^[(Ctrl–Left Bracket). And just about any character can be entered by holding down the Alt key and tapping that character's ASCII value in decimal notation on the numeric keypad.—*Robert L. Hummel*

Productivity Tip

Typecasting in Turbo Pascal 4.0 works very nicely on variables and values. However, if you try to typecast a function result to match a variable, you will run into trouble. A solution to this is to typecast the *variable* to match the function result. An example of this is

```
Pointer(LongIntVar) := PointerFunction;
```

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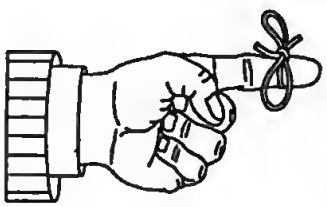
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PC TUTOR

When everything that's old is suddenly new again and confusion reigns supreme in the marketplace, it's simply another typical day for microcomputer users.

By whatever measure you may choose, personal computers are still a relatively new phenomenon. Desktop microcomputer systems just haven't been around for all that long. The IBM PC wasn't introduced until after President Ronald Reagan was first elected to office. PC hardware and software has proved to be one of the fastest evolving and most confusing segments of the computer market. The sources of this confusion are easy to identify.

During the 7 years since IBM introduced the IBM PC, personal computer users have weathered a truly phenomenal storm of new products and technologies. Nearest to our hearts has been the introduction of two major new Intel CPUs (central processor units), the 80286 and 80386, with the 80486 rumored to be waiting in the wings. We've seen a host of new and upgraded operating systems and environments, including no fewer than eight versions of *Microsoft Windows* alone! Previously impossible tasks have been made practical by large-capacity, fast, affordable hard disks. The powerful programming languages and compilers available rival mainframe performance at bargain prices. We've endured seven common floppy disk formats and seven video standards—some with built-in incompatibility. And, finally, we've seen at least two major changes to the expansion bus.

Surely now, as never before, it seems obvious that confusion reigns supreme. When the experienced flounder, what's a new user to do? Often the best technique is to take a moment to look back at where we've been. Retrospect can provide valuable insight into where we're going and help put some of the decisions that must be made into perspective.

MULTITASKING The hype, intrigue, and anticipation that heralded IBM and Microsoft's announcement of their OS/2 operating system brought the concept of multitasking to the forefront of many users' minds. The familiar PC-DOS operating system was designed to be a single-tasking operating system. That means it was optimized to run a single application at a time and, therefore, includes little support for sharing resources. Memory-resident programs brought some of the benefits of multitasking to the DOS environment. They put productivity-enhancing tools just a keystroke away and earned a place on the disks of PC owners.

So, many of us were multitasking without realizing it. The concept isn't new, but the terminology is strange to many PC owners. But is multitasking on a personal computer really new? The following quote is taken from an ad that ran in *PC Magazine*. I've eliminated the names of the product and the manufacturer, but see if you can fill them in as you read:

"If you have to wait impatiently for your personal computer to finish a job before moving on to another task, you need *Product*. This new software technology from *Maker* increases the productivity of your IBM PC by allowing you to do more with it.

"Using *Product* you can run several programs simultaneously, switching instantly from one program to another. For the first time you can write a letter while you do your financial planning. For the first time you can write text while printing other documents. For the first time you can edit programs while your program compiles. *Product* is the best investment you can make in microcomputing because it multiplies the value of your hardware and lets you use all . . . compatible programs. And if you're developing software, it ensures that you're on the crest of the hottest new wave in the business."

If you guessed that the product was OS/2 from Microsoft—sorry, you're wrong. The product being discussed is Concurrent CP/M from Digital Research, and the ad ran in *PC Magazine*, March 1983. What went wrong? If multitasking was inevitable, where has it been hiding the last 5 years? If you or your company had ridden "the crest of the hottest new wave in the business," the tide would have gone out on you long ago.

The guarded response of developers to the challenge of developing applications for OS/2 shows that they haven't forgotten the lessons of the recent past. They've adopted a "wait-and-see" attitude that you and I will ultimately benefit from. It's also important to note that the benefits of multitasking described in the ad were as valid then as they are now, but the promises made concerning increases in productivity are still largely unfulfilled.

EXTENDED EDITION The plans that IBM has for its share of the microcomputer market and its ultimate direction are still

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none too clear to most PC owners. And the introduction of Extended Edition has generated more questions than answers. Based on the generic OS/2 product jointly developed with Microsoft, Extended Edition will be available only from IBM. And although IBM makes it clear that it is not its intention to engineer Extended Edition to prevent it from running on computers purchased from other manufacturers, it's more than likely that this will be the case. OS/2 is simply too hardware-dependent to allow the type of mix-and-match system building that we've all gotten used to. Expect Extended Edition to acquire properties that limit its execution solely to IBM equipment.

Industry experts, both pro and con, have been vocal about OS/2 and Extended Edition. A feature story by Todd Katz dealing with IBM's position in the personal computer operating systems arena included the following interview with an industry expert:

" 'Taking a philosophical view,' [Kevin] Wandryk added, 'IBM has historically shown that in the mainframe and the minicomputer worlds they want the whole pie. In large systems business, they have never relied on outside vendors. My personal feeling is that in the long run, the same thing will happen to the operating system suppliers that happened to the makers of hard disks and color monitors when IBM released their XT and color monitor.' "

Katz said, "According to this scenario, IBM will continue playing various operating system suppliers against one another until its own proprietary operating system or systems are ready for release."

The story was entitled "Is CP/M Dead?" and it appeared in the August 1983 issue of *PC Magazine*. While the rationale behind the prediction is still valid, it's pretty obvious to me that hard disk and color monitor manufacturers are alive and well and still handing IBM its lunch in the quality and price departments. And even as this is being written, Microsoft is outgrowing its newly expanded facilities, turning locker rooms into office space.

THE YEAR OF UNIX Other questions nagging personal computer users today revolve around the Unix operating system. As predictable as sunspots, Unix proponents appear periodically, declaring that this is *finally* the year that Unix will take hold. Unix is a multiuser, multitasking operating system with a syntax as cryptic as its proponents are enthusiastic. "Why use OS/2," they ask, "when Unix is so well established?" James B. Morris, in an in-depth analysis of a PC-based Unix-type operating system in *PC Magazine*, made the following observations:

"The IBM PC is changing the rules of the game. Its . . . processor has a reasonable amount of 'horsepower' and it has a large addressable memory space. This change is sparking a revolution in the personal computer software scene.

"Because this new microcomputer power has created a lucrative marketplace, professional software developers are eyeing the personal computer software market with a lean and hungry look. When these people arrive on the scene, with powerful tools and high-level languages, the rules of the software game are going to change.

"The . . . operating system is going to play an important role in this transition, not only because it has emerged so early in the transition period, but because what has emerged is of such high quality."

The product was QNX; the year was 1983 ("The Powerful Tools of QNX," *PC Magazine*, April 1983). Meanwhile, in 1988, our current crop of PCs has more horsepower, larger addressable memory, and better language tools than we've ever had. But Unix still hasn't become the dominant force that's been predicted. And QNX, by the way, is still around.

APPLICATIONS Developers in the applications arena announce, with depressing regularity, that their latest product is the first in an entirely new category of software. Lotus, maker of the best-selling *1-2-3* spreadsheet product, is aggressively promoting its lastest application, *Agenda*, as the hottest new entry in personal information management. *Agenda* promises to revolutionize the way in which we work by making massive amounts of information easily accessible on a personal computer. Before you rush out and buy a copy, consider the following excerpt from a *PC Magazine* review:

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Additionally, we have mW1167 slotless numeric coprocessor cards for Acer, ALR, AT&T, Compaq, Dell, Everex, HP, Micronics, NCR, Olivetti, Tandy and Wyse 386 systems. We will soon offer an mW1167 that runs in the Micro Channel of the IBM model 70 and 80.

Dr. Robert Atwell, a leading defense scientist, calculates that NDP Fortran-386 is currently saving him $12,000 per month in rentals of VAX hardware and software while doubling his productivity!

Fred Ziegler of AspenTech in Cambridge, Mass. reports, "I ported 900,000 lines of Fortran source in two weeks without a single problem!" AspenTech's Chemical Modeling System is in use on mainframes worldwide and is probably the largest application to ever run on an Intel processor.

Dr. Jerry Ginsberg of Georgia Tech reports, "My problems run a factor of six faster using NDP Fortran-386 on an mW1167 equipped 386/20 than they do on my MicroVAX II."

Our NDP compilers and NDP utilities are the key to taking advantage of the two to five-fold increase in speed that the mW t167 provides. The compilers generate mainframe style code, while our utilities simplify ports from either the PC or the mainframe world. A new utility enables our NDP compilers to call HALO 88.

If you are curious about the benefits of the NDP/mW t167 approach, consider the following (price estimates are for complete systems):

Coprocessor	Speed (Flops)	Prices
80287-10	80,000	$3,000
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mW1167-20	2,100,000	$6,000

When driven by a 32-bit compiler, the mW1167 approaches the speed of a $600,000 VAX 8650! In fact, many of our users have reported increases in turnaround of 2 to 4 times that of their VAX! Call us for complete details.

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■ PC TUTOR

izes in the computer field. I have one of the world's most sophisticated microcomputers in my home and a second machine in my office. Why, then, does my desk look like a stationery store after a tornado?

"The answer is that I have not yet found an easy-to-use, quick and logical personal database. Sure, there are the dBASEs and the Condors and other very capable database managers. And there are the VisiDexes, the Desktop Organizers, and the Cardboxes. But these all require the user to have a strong system of organization already in place. These work fine for those with a native sense of organization, but like many writers, I require a considerable amount of 'creative clutter' and disorganization to keep the juices flowing.

"Enter *Product*. This keyword database program, though not perfect, comes very close to the sort of unstructured tabula rasa database I've been looking for. I just might uncover the top of my desk sometime this year.

"Quite simply, *Product* presents you with a blank screen on which to type—no forms to fill out, no significant strictures on the sort of information you may place on the screen. You can mark any word or number on the screen for indexing or cross-referencing. You can even add words to the index that do not appear on the file but might otherwise be of assistance to you in a search. There is also an Autokey command that automatically labels each file folder with a particular set of keywords."

The product being reviewed was *DataFax*, by Link Systems. The year, again, was 1983 ("Off the Desk and into the Disk," *PC Magazine*, April 1983). You decide if *Agenda* is a new category of software, a revolution in information management, or just another good implementation of ideas that have been around for a while.

Let's face it: owning a personal computer means living with confusion. And that confusion was just as intense in 1983 as it is today in 1988. The only effective weapon against confusion is education and information. Study the industry, both what it's doing now and what it's done in the past. Finally, never be afraid to ask questions and demand answers. Remember, those who do not study history are condemned to repeat it.

Some PC-XT compatibles have problems with 101-key keyboards

I have a Chicony 101-key keyboard for my XT clone. When I use *Microsoft Word*, the dedicated cursor keys don't stay separate; they follow the same setting as the numeric keypad. Microsoft says this happens with certain keyboards. Is there a way to overcome this problem?—*Eric L. Johnson; Cucamonga, California*

When keys are pressed and released, the keyboard microprocessor interprets this information and passes it on to the system unit as a series of scan codes. Inside the system unit, a subroutine in the ROM BIOS translates the scan codes into the appropriate action.

The BIOS must know how to interpret the scan codes from the keyboard. Plug a 101-key keyboard into a PC that is expecting scan codes from an 84-key keyboard and you've got miscommunication.

Many manufacturers changed the microprocessor program in their 101-key keyboards to compensate for lack of BIOS support and produce the same scan codes as standard 84-key keyboards. The trouble is simply that some of the keys must be represented by the same scan codes—even if they're different keys. This can confuse many software programs that key their input directly from the keyboard.

The proper combination of keyboard and BIOS can produce the correct results. Find out if the manufacturer you bought your computer from has an updated version of the BIOS. Failing that, try different keyboards on your computer while running *Microsoft Word*.

Ask the PC Tutor

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally. PC



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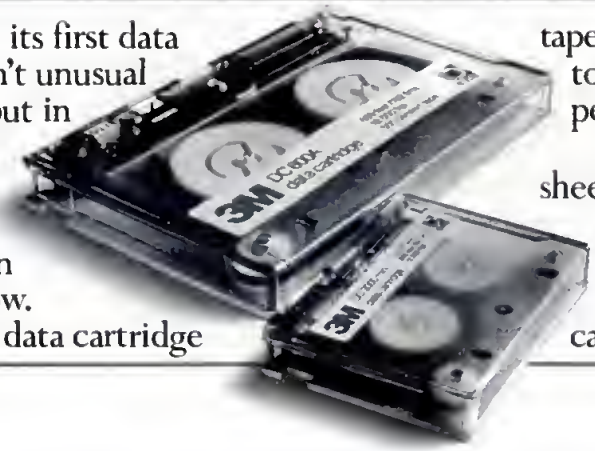


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Choosing the right hardware-and-software combination for a small, reliable, and economical LAN; recording the activities of NetWare users with the DOS FIND command.

Create a log of *NetWare* activity using the DOS FIND utility and redirection facility

Sometimes it's necessary to log the activities of some *NetWare* users. We wrote a little batch file to document the log-in and log-out of each user.

USER_LOG.BAT resides in a public file on the server. We arrange the *NetWare* LOGIN script of each user so that USER_LOG.BAT runs after the user's specific configuration is entered. The DOS environment command SET is used in the LOGIN script to enter each user's Novell LOGIN_NAME into a value: NAME.

It is necessary that USER_LOG.BAT locate a little file I called CR that contains two carriage returns. The carriage returns in the file CR are then redirected against the DOS DATE and TIME commands. Respectively, the results of these commands are filtered through the DOS FIND command and redirected into an individual's user log file.

The Novell LOGIN script for each user should include

```
:DOS SET NAME=LOGIN_NAME
:  user specific system configurstion
:exit "user_log"
```

The statement `exit ''user_log''` will call the batch file shown in Figure 1.

Note that the `MENU %NAME%` statement in the batch file starts the network menu with the user-specific menu file "username.MNU."—*Dietmar Wintersberger; Wels, Austria*

```
ECHO OFF
CLS
CD \PUBLIC\LOG
ECHO / / / / LOGIN  >>%name%.log
date <CR | find "Cur" >>%name%.log
time <CR | find "Cur" >>%name%.log
CD \PUBLIC
MENU %NAME%
F:
CD \PUBLIC\LOG
ECHO . . . . LOGOUT >>%name%.log
date <CR | find "Cur" >>%name%.log
time <CR | find "Cur" >>%name%.log
ECHO  >>%name%.log
ECHO
CLS
CD \LOGIN
ECHO    TURN OFF YOUR WORKSTATION OR RE-LOG WITH LOGIN %NAME%
LOGOUT
```

Figure 1: *A batch file that documents the log-in and log-out activities of each user.*

To use this suggestion, you should log in as SUPERVISOR and copy USER_LOG.BAT to F:\LOGIN (or whatever drive LOGIN is on). Next, you would create a new subdirectory called LOG in F:\PUBLIC. Create a little file called CR with your word processor and copy it along with the DOS file FIND.EXE to F:\PUBLIC\LOG.

USER_LOG.BAT uses the FIND function to search for the first part of the word "Current" coming back with the time and date, so make sure that the C is an uppercase letter. This is a nice filter technique that keeps trash out of the log file. Many readers know that an excellent logging and control capability is now contained in *NetWare*, Version 2.1, but this additional feature probably isn't enough to justify the cost of the upgrade.

Productivity Tip

Many people are confused by the terms *asynchronous* and *synchronous*. These are two different ways of arranging the data in a serial stream. Asynchronous means every 7- or 8-bit data character is separated by start and stop bits. Synchronous means that hundreds of characters are strung together inside data frames to reduce overhead.

Join ARCnet with clustered CPU systems to make a small campus LAN sing

We need your advice on how to configure a network. I work at a private school where

■ CONNECTIVITY CLINIC

we have one main campus building and 13 dormitory buildings. In the main building, we need to use the network for accounting and standard office functions. We will have about a dozen terminals in the main building.

The dormitories are connected to the main building by telephone lines. No wire is longer than 800 feet. Counselors in the dorms need to enter the network to read student records and make updates. Reliability is very important to us, but so is cost.—*Sam Scott; Yonkers, New York*

This reader's original letter contained a lot more information about the physical plant and requirements. However, this edited version conveys the reader's two distinctly different network problems: running networked accounting and administrative applications within the main building, and providing service to people in the 13 buildings separate from the main building. Fortunately, both applications have mutually compatible off-the-shelf solutions.

For networking software, I suggest you use Novell's *Advanced NetWare*, Version 2.0a or 2.1. The Novell software is reliable, and has excellent performance, and it is supported by many integrators and third-party vendors. I advise you to run the Novell software on an 80386-based machine on Novell's "approved" list. None of these machines is inexpensive; however, when Novell releases an 80386 version of *NetWare*, you will want to have the opportunity to upgrade.

The network in the main building will need good LAN interface cards and cabling. My personal preference for installations such as yours is ARCnet. Many vendors market good ARCnet products, but my advice is to specify that your integrator/installer use cards from either Standard Microsystems Corp., Pure Data, or Thomas Conrad Corp.

ARCnet requires the installation of thin coaxial cable. Standard Microsystems markets a version using twisted-pair wiring if cable installation is impossible and you need an alternate solution.

Don't let a consultant or integrator talk you into using Token-Ring Network interface cards and cabling. For you, Token-Ring is not worth the cost.

The solution I propose for the other buildings provides better security and reliability, and is less costly than ordering PCs for every dorm.

I suggest you use what we call clustered CPU systems. These systems separate the CPU and memory from the screen and keyboard. The CPU and memory stay on a circuit board installed inside the LAN server. The screen and keyboard connect to the circuit board through twisted-pair wiring. The distances you quoted are fine for this operation and you need only two wire pairs.

How the competition stands

Introducing the modem with a sleek new stand-up* design. Telebit's new T1000 Multi-Speed modem. The modem that not only looks different, but is different. With more features. More performance. And a surprisingly low price.

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What makes the T1000 so different? For one, you get a choice of more speeds. The T1000 can send and receive data at 300, 1200, 2400, or 9600 bps using ordinary dial-up phone lines.

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In each dormitory, you will have relatively inexpensive (less than $300) terminals with screens and keyboards. There is little to steal or damage. These terminals have no floppy disk or hard disk drives, but they act just like PCs because their CPUs have access to the server's hard disk drive. Each user runs PC software and is a part of the network. This is perfect for entering information into a database or running many kinds of programs. The screens are monochrome, but in this application that should not be a significant limitation.

I recommend products from one of two companies: Alloy Computer Products or Data Voice Systems. Both companies have Novell-compatible clustered CPU systems that use RS-232C signaling to the terminals.

The hardware and software are available to meet your needs with reliability and economy. You just have to find the right combination and put it together.

Productivity Tip

The IBM Cabling Plan describes different kinds of cables used in building wiring:
Type 1: Two shielded twisted pairs
Type 2: Two shielded and four unshielded pairs
Type 3: Four unshielded twisted pairs
Type 5: Two fiber-optic pairs
Type 6: Two shielded twisted pairs.

Type 3 cable is voice telephone wire. Type 6 cable is made from stranded wire and is more flexible than Type 1.

Productivity Tip

If you're confused by the ISO Model Layers, think of it as a railroad system:
Physical Connection: The tracks
Data Link Control: The signal lights
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Transport: Freight yard dispatcher
Session: Opens boxcars
Presentation: Loads freight on trucks
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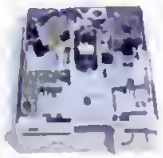
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T.W.

Before this election, T.W. 'Dillo never thought of himself as much of a political animal. "Kissing armadillo babies was not quite my style," T.W. was quoted as saying at a recent press conference. "I was much more interested in outfitting offices with speedy IMS computers than I was in running for one."

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Artwork by Todd Winters

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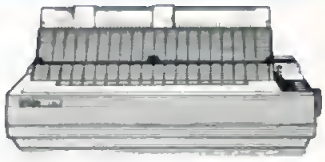
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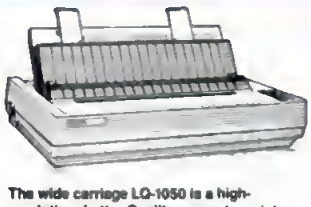
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World Port 1200 Ext	159/150
2400 Ext w/AC Adapter	259/250
Toshiba cable for Ext Modems	20
Numeric Keypad T1000/1200	99/90
Numeric Keypad T3100/3120	99/90
Brooklyn Bridge	99/90
Battery Watch by Traveling sw	39
Desk Link by Traveling sw	129/120
Laplink Plus by Traveling sw	109/100

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ALQ 200 Color 16/24 pin	439/469
ALQ 300 Color 16/24 pin	629/669
ALQ 224E Color	599
ALQ 324E Color	749
BiDi Tractor 200/300	70/90
Ribbon ALQ Black/Color	16/20
P2000 w/Tractor	679
P2100 w/Tractor	1079
P2400 Color, w/Tractor 24 pin	969
★ **DICONIX InkJet 150 parallel** with 3' or 6' cable	329
With any Laptop	299
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PRO PACK 20 MB (ST 225)	265
PRO PACK 30 MB (ST 238)	285
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PC/XT Mtng Kit & Filler Plate	10
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SEAGATE ST 251-1 28 ms	449
AT Mounting Kit	10
ARCHIVE: Uses Floppy Cont/DC2000 40 MB External for PC/XT	449
MOUNTAIN: Uses Floppy Cont/DC2000 40 MB Internal for AT	379
DC 2000 Single/Box of 5	25/120
DC600 Single/Box of 5	30/140

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NEC MultiSync II-1402	589
NEC MultiSync PLUS	879
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LAP TOP Modems	See SYSTEMS
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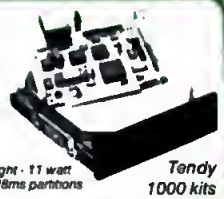
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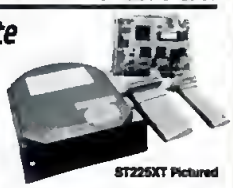
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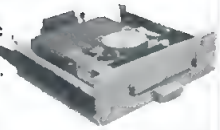


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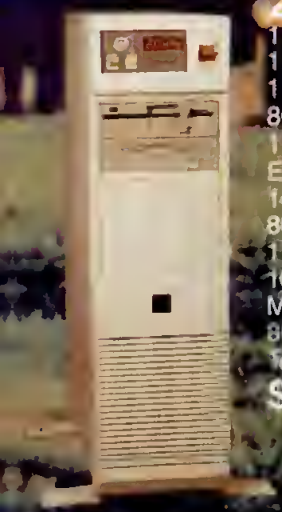
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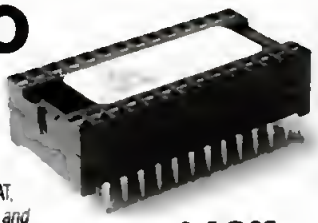
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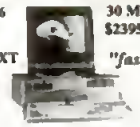
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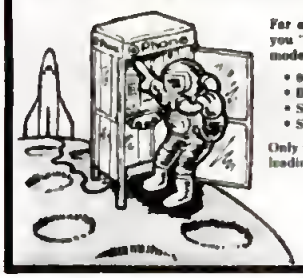
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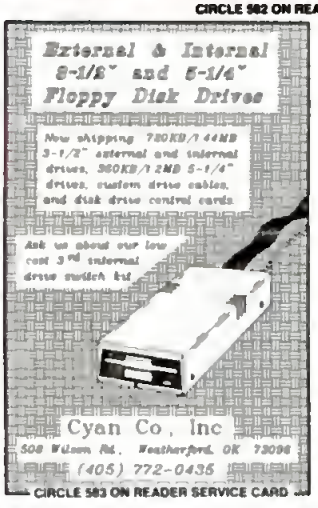
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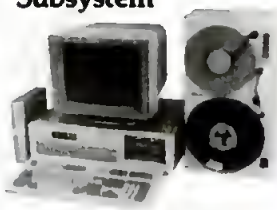
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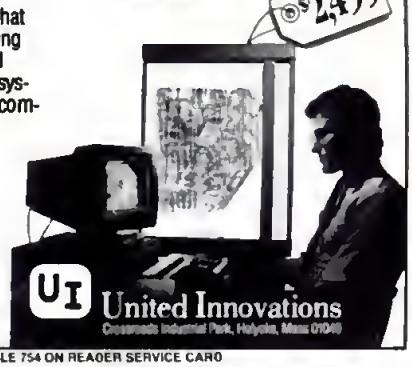
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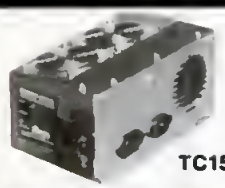
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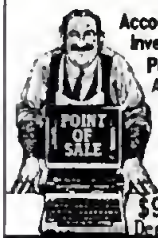
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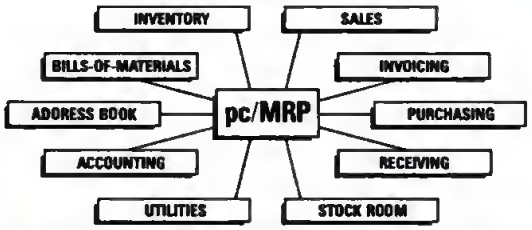
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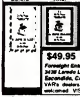
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COMING UP

LAN GATEWAYS, PART 1 Imagine a world where PCs and mainframe computers share corporate information without the need for dedicated links. In the first of a two-part series, workgroup systems editor Frank J. Derfler, Jr., suggests a solution to this dilemma: LAN gateways, which provide a portal that allows all connected stations to access the 3270 mainframe through a single link. In this issue we review the Harris 9300 system and the Banyan Corporate Network Server. These two systems are complete local area networks with gateway services built into a dedicated file and print server.

WORDPERFECT 5.0 Among the growing ranks of word processors in today's market, *WordPerfect* 5.0 stands out with such features as bit-mapped graphics and font management. Dean Hannotte explains why this revamped version of *WordPerfect* may now be the most powerful, configurable, and multitalented word processing program to appear on the PC.

20-MHz 386 COMPUTERS Not very long ago, 20-MHz 386 microprocessors were the fastest computers money could buy. Now the 20-MHz mark is the expected speed level of any 80386-based model, and the plethora of 20-MHz 386 computers on the market is driving down the cost and improving the quality of this once-revolutionary product. *PC Magazine* contributing editor Winn L. Rosch and other reviewers evaluate 15 of today's top 80386 20-MHz machines and find them in almost every way superior to their predecessors.

HAND SCANNERS Scanners excite an undeniable fascination in even the most blasé PC users: witnessing a photograph or magazine article appear on your screen as a desktop scanner reads it is truly exciting. On a smaller scale, today's hand-held scanners convert graphics, text, or both into a computer image, often for less cost. Mike Falkner evaluates hand scanners from The Complete PC, DFI, Logitech, Packard Bell, Saba Technologies, and TransImage and compares their usefulness with that of desktop models.

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AFTER HOURS

GAMES

Blockbuster: A Treat For Arcade Fans and Demolitionists Alike

BY DONALD B. TRIVETTE

Mindscape's *Blockbuster* picks up where the company's classic arcade game *Breakout* left off. As in the original, your goal is to destroy a wall, brick by brick. This was fun 5 years ago, but does it still hold up today?

For arcade enthusiasts, the answer is yes. Mindscape has added enough enhancements and variations to keep the game lively and interesting for even a jaded player.

In *Blockbuster*, as in *Breakout*, the basic idea is to bust up a brick wall by keeping a ball ricocheting around the playing area with the aid of your trusty bat. You can use the cursor keys to move the bat horizontally along the bottom of the screen, but a joystick works better, and a mouse works best of all.

There are a few obstacles, such as aliens, who can cause the ball to veer from its course. Even inanimate objects such as the bricks themselves seem to conspire against you—some are invisible or just plain indestructible. In a new twist, other bricks require multiple hits before they will collapse.

Also new is the ability to catch tokens that drop sporadically from the top of the playing area, with which you can purchase weapons to help with the demolition. You can choose from among nine weapons, including lasers, bombs, a force field, and missiles.

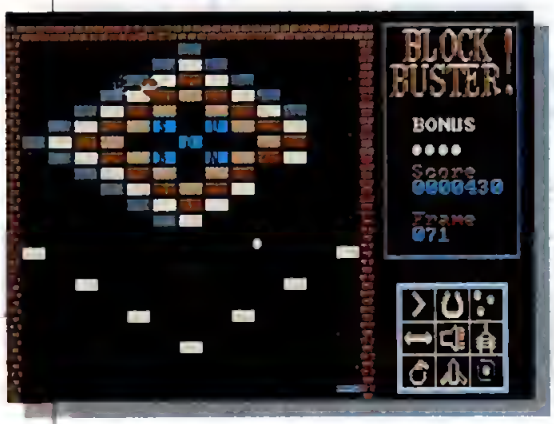
With this collection of armament in your possession, you'd think blasting a few bricks would be easy. It's not. After destroying the first wall, there are 79 others waiting to challenge you—each progressively more difficult to destroy than the ones before it.

One of the biggest flaws in *Blockbuster* is that the $34.95 game does not support EGA graphics. CGA games—even arcade games—are hopelessly dated. The second flaw concerns quitting *Blockbuster*. The instructions say you press Esc and type QUIT, but that works less than half of the time, and the only alternative is to reboot.

Despite these flaws, the arcade-game fans who liked *Breakout* are sure to love *Blockbuster*.

List Price: *Blockbuster*, $34.95.
Requires: 256K RAM, CGA, DOS 2.0 or later (mouse or joystick optional). Copy protected.
Mindscape Inc., 3444 Dundee Rd., Northbrook, IL 60062; (312) 480-7667.

CIRCLE **693** ON READER SERVICE CARD



Destroying the B-O-N-U-S bricks (which don't appear until you're on the 75th wall) in sequential order earns extra points in Blockbuster.

While putting in Mean 18 is as difficult as it is in real golf, reading the greens from the overhead view can make it easier.



GAMES

Duffers' Delights On-disk: Accolade's Mean 18 World Tour of Famous Courses

BY GREG PASTRICK

Now that the summer's heat wave has turned golf courses across the land into large-scale straw mats, the best place to hit the links this fall may be on your PC. With four course disks available, Accolade's *Mean 18* is a virtual PGA tour of 13 championship courses.

If you need a challenge beyond these on-disk offerings, you can design your own tees, fairways, and greens with *Mean 18*'s Course Architect, a drawing and design module.

Mean 18 was first released in June 1986. Aside from its EGA compatibility (introduced in spring of this year) it looks and behaves as the original.

While the course designs are often complicated to play through and around, the overall look of the graphics is fat and flat, and the characters and scenery are blurry.

The actual play is stiff and repetitive. There's no sense of the many adjustments and alignments in body and club that are found in real golf. You simply take your strokes by monitoring the on-screen power meter (which measures the force of your swing) and tapping the Spacebar at the top and bottom of the swing. Your club selection and the points at which you tap the Spacebar determine the distance the ball travels and whether you hook or slice it.

Aiming is primitive, but putting is as difficult on-screen as in real golf.

What you really want to buy *Mean 18* for is the design module and the course selection disks. A half-hour with the Course Architect can produce the most amazingly difficult and enjoyable holes.

Fact is, there isn't another piece of golf software that lets you play St. Andrews, Pebble Beach, and Augusta National (Famous Course Disk Volume I), Turnberry, Inverness, and Harbour Town (Volume II), Olympic, Las Colinas, and Muirfield (Volume III), Doral, Castle Pines, and Kapalau (Volume IV) all with one program.

List price: *Mean 18* and Famous Course Disk Volume I, $44.95; Famous Course Disk Volume II, $19.95; Famous Course Disk Volumes III and IV, $34.95.
Requires: 256K RAM, DOS 2.0 or later. Copy protected. Accolade Entertainment Software, 550 S. Winchester Blvd., #200, San Jose, CA 95128; (408) 296-8400.

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AFTER HOURS

ON-LINE SERVICES

Dialog's Knowledge Index Puts a Library of Information at Your Fingertips

BY DONALD B. TRIVETTE

Where do you go for information on everything from medicine to computers when the library is closed? Once the answer was the encyclopedia, but these days you can go to your computer and an information retrieval service such as Dialog's Knowledge Index—even if the library is open.

The Knowledge Index is a subset of Dialog Information Services. Dialog bas placed more than 60 of its 320 databases in the Knowledge Index. The company charges a flat $24 per hour to use KI, which is available only after 6 P.M. on weekdays, as well as on weekends and holidays.

The company says that KI is used mostly by those seeking information about medicine and computers; consequently it has multiple offerings in eacb of these areas. In computers, for example, there are six databases: one is put together by the Institute of Electrical and Electronics Engineers; the other five are the International Software database, the Microcomputer Index, the Computer Database, the Microcomputer Software and Hardware Guide, and the Business Software Database.

There are 13 medical databases. They range from the National Library of Medicine to Consumer Drug Information and from a cancer literature database to one that covers sports, fitness, and recreation.

While some offerings, such as Consumer Drug Information and Consumer Reports, are full-text databases, most contain only citations and summaries of articles. You can use KI's Order command to send a copy of these articles to your mailbox for about $10 each.

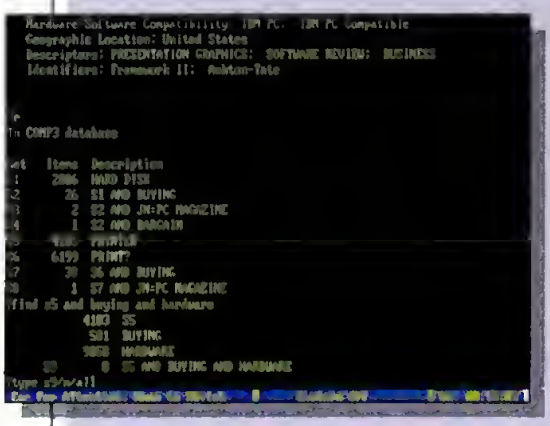
My own two favorite databases are BOOK1, which is an electronic copy of *Books in Print*, and MAGA1, an index of over 370 popular American magazines. Using just these two sources, in less than 5 minutes I can find what bas been written about virtually any topic.

Perhaps the most surprising feature is KI's ease of use. You need only remember a few commands: Begin to select a database; Find to locate an article; and Display and Type to display the citations or full text on your screen. In scores of searches on dozens of databases, my longest wait was 2 seconds.

The biggest problem with KI is deciding which database in a category to search. For instance, which of the many computer databases do you look at to find reviews of a specific word processor? Indeed, to be thorough you must search them all—but given KI's speed, that takes less time than driving to the library.

List Price: Knowledge Index, $24/hour; $35 initial fee. **Requires:** Modem, communications software, DOS 2.0 or later. Dialog Information Services Inc., 3460 Hillview Ave., Palo Alto, CA 94304; (415) 858-2700.

CIRCLE **695** ON READER SERVICE CARD



Knowledge Index's Recap command lets you review the results of previous searches, this search found two articles about hard disks in PC Magazine.

ON-LINE SERVICES

Nexis: All the News That Fits into Print

BY EDWARD MENDELSON

If you need to know who's buying buildings in Buffalo or the antidote to arsenic, Mead Data Central's Nexis is the on-line service to call. It's also the service to call for proxy statements filed with the SEC, the details of Joan Collins's divorce, or the *Encyclopedia Britannica*'s history of Zoroastrianism.

Nexis's database doesn't include everything printed in American newspapers and magazines during the past 5 to 10 years, but it's getting closer all the time. You can search through any or all of about 400 information sources, including magazines ranging from *Policy Review* to *Public Health Reports* to *People*, national newspapers like tbe *Washington Post*, plus a hundred local and specialized business newspapers. Most of the files extend back to the early 1980s.

Nexis takes only a few seconds to produce information on patents, federal regulations, political biographies, and drug evaluations. You can call for the text of the "MacNeil/Lebrer Newshour" but not the pictures. The same limitation applies to *Playboy* magazine.

When you're on-line with Nexis, you first select a "library" of information banks such as the *Encyclopedia Britannica*, medical journals, or the Nexis collection of general and business publications. Within each library, you choose to search through individual magazines, groups of magazines, or the library as a whole. You initiate searches by entering keywords and Boolean operators. A keyword can be anything other than "noise words" such as *and* and *which*.

Even when you search the full database, you wait less than a minute before getting a report on the stories that matcb your criteria. You can then read through each document in full or ask for a display of the keywords you specified in a few lines of context from each story. At any time, you can switch from full text to keywords-in-context or specific categories of information such as birthdates.

Connect time costs a reasonable $20 per hour, but you have to add at least $12 an bour for the network that gets you connected. Each search through an individual file of a magazine or newspaper costs $5, although you can search through all magazines for $14 and all newspapers for $19.

Nexis was originally designed to be used from dedicated terminals, and it has the characteristic ugliness and ungainliness of mainframe software. But its commands are simple to learn, and it works at impressive speed.

List Price: Nexis, monthly subscription, $50; connect time $20/hour; network time $12/hour (WATS, $17/hour); individual searches range from $5 to $32, with quantity discounts. **Requires:** Modem, communications software, DOS 2.0 or later. Mead Data Central, P.O. Box 933, 9393 Springboro Pike, Dayton, OH 45401; (513) 865-6800.

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AFTER HOURS

ON-LINE SERVICES

From Booking a Flight To Reserving a Room, Eaasy Sabre Makes Planning Your Trip a Cinch

BY DONALD B. TRIVETTE

If you're tired of talking to travel agents and air reservations clerks, give your mouth a rest and your fingers some exercise. Sabre, the world's largest travel database, is now available in a user-friendly version called Eaasy Sabre, located on the CompuServe information network. The peculiar spelling of "easy" is to remind you that American Airlines is the owner of the Sabre system.

Eaasy Sabre is accessed from the Travel item on the CompuServe main menu. It is a gateway service: the CompuServe mainframe in Ohio passes your call on to the Sabre mainframe in Dallas, Texas. Using the Dallas mainframe, Eaasy Sabre allows you to display information about and book passage on a huge number of flights. Infrequent travelers can use Eaasy Sabre's multiple-choice menus to set up their trips, while the seasoned booker will prefer to enter commands directly.

The service shows on-time performance statistics, and it provides up-to-date weather forecasts for selected cities.

One advantage that Eaasy Sabre has over other airline-reservations systems such as the Official Airline Guide (OAG, also on CompuServe) is that it lets you make hotel and motel reservations. The Eaasy Sabre mainframe has access to a network of 125 hotel chains. Sabre also lets you reserve cars at 36 rental companies, a service not available on OAG.

While OAG carries a surcharge of 53 cents per minute during prime time (8 A.M. to 6 P.M.) and 35 cents per minute in off-hours (6 P.M. to 8 A.M.), Eaasy Sabre has no surcharges. It's yours for the cost of CompuServe alone, a deciding factor for me.



Making hotel reservations with Eaasy Sabre really is easy. You can choose from six qualifiers, including hotel chain, location, and rate.

List Price: Eaasy Sabre, (CompuServe prices): prime time (300 bps) $6/hour; prime time (1,200 bps) $12.50/hour; after hours (300 bps) $6/hour; after hours (1,200 bps) $12.50/hour.
Requires: Modem, communications software, account with CompuServe. CompuServe, 5000 Arlington Centre Blvd., Columbus, OH 43220; (614) 457-8600.

CIRCLE **697** ON READER SERVICE CARD

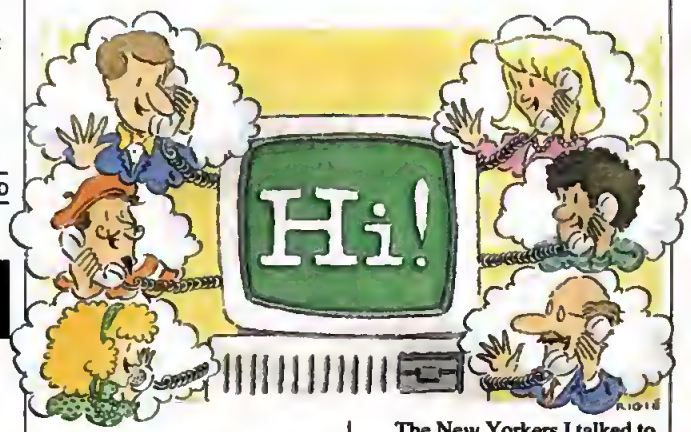
ON-LINE SERVICES

For a Good Time, Call Aline

BY JONATHAN MATZKIN

If swinging singles clubs symbolized the free-love sixties, then telephone party lines epitomize the don't-touch-me eighties. People spend hours talking to callers they don't know and can't see. It was just a matter of time until the PC caught up with this trend. Now, with Aline, a modem-based chat line, you can use your computer to meet people eighties-style.

You simply dial 540-LINK (currently available only in the 914, 212, 718, and 516 area codes) with your modem, and you are ready to converse with anyone else who is currently connected. The service costs 95 cents for the first minute and 20 cents for each additional minute. Charges appear on your monthly phone bill.



After selecting live conversation from the main menu, you choose a handle. Next, you get a list of handles of the other people who are connected. To send a message, specify a recipient, type a brilliant two-line missive, and wait for a response or send a message to someone else. Your correspondent gets your messages and a prompt for a response. The cycle of messages and responses forms a thread that goes on as long as you both continue to answer. You can easily maintain multiple threads with many callers.

When a longer message seems appropriate, you can leave the live message section and go to Aline's mailbox section. Callers can create mailboxes under as many different handles as desired.

Aline will be available nationwide this fall, according to NewCom Link. The company is a subsidiary of Le Nouvel Observateur, a French firm that supplies on-line services to the more than 3.5 million videotext terminals in French households. Aline began in France, and French callers can easily start up a conversation with users on the New York line.

So far, though, Americans can initiate French connections only with additional software that is available on request from NewCom Link. The company says that the U.S.-to-France connection will be available as a menu item before long.

The New Yorkers I talked to on Aline were interesting and often amusing, and the French callers seemed just thrilled to be speaking to an American.

List Price: Aline, 95 cents first minute, 20 cents each additional minute. **Requires:** Modem, communications software, DOS 2.0 or later. NewCom Link, dial 540-LINK in the 914, 212, 718, and 516 area codes.

CIRCLE **696** ON READER SERVICE CARD

NEW!

I met a guy last night on

Aline℠

a really special guy…
*I called 540-5465**
with my computer and

before I knew it, I was tapping away, zipping messages off to five guys at once and having the time of my life. But this one guy, he's really special. It almost seems like he's there to tuck me in at night.

Funny how you can get to know someone so quickly. I used to think I was shy, but ***Aline***℠ *has changed all that. Since it's all anonymous and one-on-one, people don't hesitate; they're friendly, intimate and things happen fast. My friends all want to know where I found him—and I haven't even met the guy yet.*

Let's see…his last message read, "Dinner tonight at 8?" "Love to!" I sent back. And who knows?



JUST TURN ON THE CLOSEST PC AND CALL!

*This service is designed to receive calls from personal computers *only*. Set your modem to: 1200-N-8-1 and once you're connected, press Return or Enter. That's it! Each call is charged directly by NYTelephone to the phone you call from: 95¢ the first minute; 20¢ each additional minute.

Aline℠ is available in the NYC metro area from 212, 718, 516 and most 914 numbers. From NJ, Connecticut and nationwide, call: **(212) 826-3894** for information.

Aline℠
CALL WITH YOUR PERSONAL COMPUTER
540-5465

NO PC? NO PROBLEM!

Rent a cute little terminal from us for only $9.95/month and get on Aline℠ today!

CIRCLE 741 ON READER SERVICE CARD

© 1988, NEWCOM LINK

ON-LINE SERVICES

Prodigy and PC-Link: Low-Cost, Graphics-based On-line Services

BY NEIL J. RUBENKING

Remember the future? The Home Computer was going to wait on us, a dutiful electronic servant. No more shelves of encyclopedias. No need to go out to shop—just view items on the computer screen and have your selections delivered to your home. Electronic mail, electronic banking, electronic news—the Home Computer would supply it all.

Prodigy and PC-Link are two new on-line services that aspire to make this dream of the Home Computer a reality. The Prodigy Services Company (formerly known as Trintex) is a partnership of IBM and Sears, and PC-Link is a joint effort of Tandy Corp. and Quantum Computer Services. Both use proprietary graphics-based software and have a base price of $9.95 per month, though PC-Link adds per-minute surcharges for Plus services (which include forums and electronic mail) and daytime use. At this writing, Prodigy is operating in Atlanta, Hartford, and San Francisco and PC-Link is just finishing a nationwide beta test.

Prodigy

Prodigy Services is a marketing company that uses technology, not a technology company. That means you don't need a degree in computer science to use Prodigy. Just use the Tab and Enter keys to choose from a set of commands that remain the same throughout the system.

Prodigy uses three-line advertisements at the bottom of each screen to pay most of its costs. You can "dive" into the ads to get more information or to purchase the item.

Consumer Reports, IBM, J. C. Penney, Panasonic, and hundreds of other companies offer goods or information. You can also shop for groceries and refer to past purchases for a shopping list and get a running total. Fitness expert Jane Fonda, movie critic Gene Siskel, and sports commentator Howard Cosell provide answers to members' questions.

Prodigy doesn't seem designed for serious computer users. For instance, the software won't recognize any hard disk besides C:, and if transmission is interrupted the computer locks up. These kinks should get ironed out as more sophisticated users join the system.

List Price: Prodigy, $9.95/month. **Requires:** 512K RAM, graphics adapter, modem, DOS 2.0 or later. Not copy protected. Prodigy Services Co., 445 Hamilton Ave., White Plains, NY 10601; (914) 993-8000.

CIRCLE 699 ON READER SERVICE CARD



Prodigy members can match wits with Carmen Sandiego, of Broderbund's Where in the World Is Carmen Sandiego? *Ads help defer the cost of the system.*

PC-Link

Tandy plans to bundle the PC-Link on-line service with its computers, its *DeskMate/PC* software, and any modem purchased at a Radio Shack store. But PC-Link is much more than a Tandy support service. It provides many of the same services as Prodigy, and a few that Prodigy doesn't. For example, PC-Link members can look up topics in Grolier's American Academic Encyclopedia and can conference with one another in real time.

PC-Link uses Tandy's *DeskMate/PC* system, with overlapping windows, multilevel pull-down menus, and function-key commands. The program runs in high-resolution graphics mode, though it makes little use of graphics. Unfortunately, its text display is about 1/10 the speed of a character-based system. Quantum is working on the speed and plans to add more graphics.

Like Prodigy, PC-Link has on-line shopping and expert advice, but the retailers aren't major national companies and the experts aren't celebrities. Instead, this service emphasizes information and "on-line community." PC-Link encourages interaction between members with electronic mail and offers forums for posting public messages, software libraries for exchanging programs, and real-time conferencing.

News, weather, sports, stock quotes, help with homework—you get them all with these on-line services. Prodigy flaunts an impressive weather map, though its news stories are necessarily short. PC-Link's Tutoring Center will even help your kids with answers to their homework questions.

The future? PC-Link, which was scheduled for a September release, will immediately offer direct connections in 600 cities via Telenet and Tymnet. Since Prodigy customizes its service to each city, it will be adding cities gradually, aiming at nationwide coverage by the early 1990s.

List Price: PC-Link; $9.95/month for basic service; 15 cents/minute surcharge (7 A.M to 6 P.M.); additional 10 cents/minute surcharge for Plus services; $29.95 for software. **Requires:** 384K RAM, graphics adapter, modem, MS-DOS 2.11 or later or PC-DOS 3.2 or later. Not copy protected. Quantum Computer Services Inc., 8619 Westwood Center Dr., Vienna, VA 22180; (703) 448-8700.

CIRCLE 698 ON READER SERVICE CARD

AFTER HOURS INDEX

On-line Services
On-line services to help you plan trips, meet people, and stay informed
Mean 18
Golfing without a caddy
Blockbuster
Good, clean, brick-busting fun from Mindscape

"The Dell System 220 runs most PC Labs system benchmark tests at speeds that would make you think you're running a 386."
—JOHN DICKINSON, PC MAGAZINE

"...the System 220 has more going for it than just speed."
—PC WORLD

"...includes a year's on-site support...in the price of the computer. This is the sweetest support deal offered by any computer vendor in the industry."
—ERIC KNORR, PC WORLD

"The hot item from a technical point of view is the System 220. This machine runs a 286 processor at 20 MHz, which is its major claim to fame."
—WILL FASTIE, PC WEEK

"...the Dell machine is renewed evidence that the price of 286-based desktop equipment continues to drop rapidly, making such machines very attractive for daily work under MS-DOS even as they hold out the promise of running OS/2 in the future."
—WILL FASTIE, PC WEEK

The reviews are beginning to pour in.

And they read like a wish list for every power user looking to exceed the ordinary limitations of a 286 personal computer.

The computer everyone is praising in such glowing terms is the Dell System 220.

The first 286 personal computer with a clock speed of 20 MHz.

It's totally compatible with MS-DOS and MS OS/2 and is faster than many 386 computers. Yet it sells for much less.

Because you buy it direct from us.

Eliminating the mark-ups and margins of computer stores.

We design and build every Dell computer right here in Austin, Texas.

We put each and every one through a comprehensive burn-in and a battery of diagnostic tests before we ship it.

And after we ship, we give you the best technical support you'll find anywhere in the computer industry.

Our technicians are on the phone from 7AM to 7PM every business day. Almost any question you may have about a Dell system or its software can be answered over the phone.

And, in the rare case, that your question can't be answered by an on-line technician, we'll send a Honeywell Bull technician by the next business day.

A full year of on-site Honeywell Bull service is included within the purchase price of your Dell system.

Your Dell computer also comes with a thirty-day money back guarantee.

And we back every one of our computers with a one year limited warranty on any materials or workmanship.



Dell Tech Support is open from 7AM to 7PM (CST) from Monday to Friday. In most cases, our technicians can answer any question over the phone. Even if the question involves a third-party component or software program.

For more information on Dell computers, read the reviews in the trade press, open the opposite page, review our product offerings, and call us at (800) 426-5150.

You'll like what we have to say.

CIRCLE 539 ON READER SERVICE CARD

"The Dell System 220 runs most PC Labs system benchmark tests at speeds that would make you think you're running a 386."
–JOHN DICKINSON, PC MAGAZINE

"...the System 220 has more going for it than just speed."
–PC WORLD

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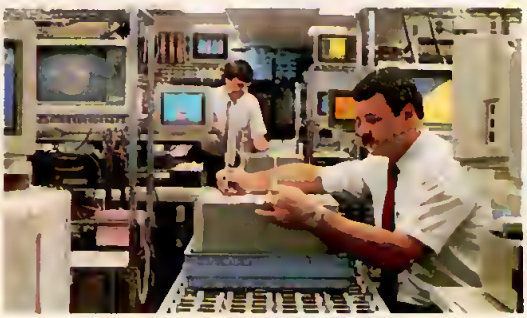
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